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22 JULY 1986

# USSR Report

## EARTH SCIENCES

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# USSR REPORT

## EARTH SCIENCES

## CONTENTS

METEOROLOGY

Computer Modeling Aids Studies of Precipitation Formation
(V. Korneyev; IZVESTIYA, No 82, 23 Mar 86)..... 1

Progress in Improving Weather Forecasting Viewed
(Andrey Pralnikov; NEDELYA, No 1, 30 Dec 85)..... 2

New Precipitation Map of World Ocean
(E.G. Bogdanova; IZVESTIYA AKADEMII NAUK SSSR:
SERIYA GEOGRAFICHESKAYA, No 1, Jan-Feb 86)..... 3

Drought, Solar Activity Link Established by Leningrad Geophysicists
(TASS, 28 Feb 86)..... 4

OCEANOGRAPHY

Electromagnetic Desalinating and Oil Clean-up Method
(KAZAKHSTANSKAYA PRAVDA, 18 Mar 86)..... 5

Airborne Laser Fluorimeter for Detecting Water Pollution
(M. Yeremyants; VODNYY TRANSPORT, No 156, 28 Dec 85).... 6

Research Ship 'Nesmeyanov' Heads for Vietnam Coast
(Yu. Yudin; TRUD, 17 Jan 86)..... 7

Heated Diving Suit for Offshore Oil Rig Workers
(Yu. Anatolyev; NEDELYA, No 1, 30 Dec 85-5 Jan 86)..... 8

Complex for Ocean Study from Space and Hydroacoustic Stations
(SOVETSKAYA ESTONIYA, 18 Feb 86)..... 9

Sea Provides Heat for Dwellings
(TASS, 27 Apr 86)..... 10

Computer-Aided Studies of Tsunami Zones on Pacific Coast
(TRUD, 14 Mar 86)..... 11

Monograph on Prospective Developments in Oceanology
(NTR: PROBLEMY I RESHENIYA, No 5, 4-17 Mar 86)..... 12

Three-Dimensional Cauchy-Poisson Problem for Area of Variable Depth
(A.A. Dorfman; DOKLADY AKADEMII NAUK SSSR, No 2, Jan 86) 13

New Data on Geology of Yap and Central Faults in Philippine Sea
(S. A. Shcheka, R. G. Kulinich, et al.; DOKLADY AKADEMII NAUK SSSR, No 2, Jan 86)..... 13

Heat Flow and Geodynamic Model of Western Pacific Ocean Transition Zone
(V.I. Ilichev, Yu. V. Shevaldin; DOKLADY AKADEMII NAUK SSSR, No 2, Jan 86)..... 14

Calculation of Spatial Distribution of Dissolved Petroleum Hydrocarbons in Tidal Estuary
(V.V. Anikiyev, O.V. Zaytsev; DOKLADY AKADEMII NAUK SSSR, No 6, Dec 85)..... 14

Cauchy Problem for Linearized System of Navier-Stokes Equations Considering Compressibility
(A.K. Shatov; DOKLADY AKADEMII NAUK SSSR, No 6, Dec 85). 15

Asymptotic Form of Stationary Solutions of the Navier-Stokes Equations for Large Reynolds Numbers
(S.I. Chernyshenko; DOKLADY AKADEMII NAUK SSSR, No 6, Dec 85)..... 15

Steady Distortion of Shape of Geoid and Normal Gravity Field under Influence of Tidal Potential
(S.S. Ivanov; DOKLADY AKADEMII NAUK SSSR, No 6, Dec 85). 16

Experimental Study of Turbulent Diffusion Parameters in Ocean
(V.V. Anikiyev, O.V. Zaytsev, et al.; IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA, No 11, Nov 85)..... 16

Influence of Stratification in Near-Surface Water Layer on Intensity of Gas Exchange Between Atmosphere and Water
(V. F. Brekhovskikh, V.I. Bratkov; IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA, No 11, Nov 85)..... 17

Physical Interpretation of Law of Frequency of Recurrence of Tsunami Heights
(R. Kh. Mazova, Ye. N. Pelinovskiy, et al.; VULKANOLOGIYA I SEYSMOLOGIYA, No 1, Jan-Feb 86..... 18

Manganese Accumulation in Fluid Phases Interacting with Rocks or Melts
(V.F. Geletiy; DOKLADY AKADEMII NAUK SSSR, No 1, Jan 86). 18

Study of Content of Trace Elements in Marine Aerosols and Surface Microlayer of Sea
(V.D. Korzh; DOKLADY AKADEMII NAUK SSSR, No 6, Feb 86)... 19

Nonlinear Waves on Surface of Fluid Layer with Constant Vorticity
(V.I. Shrira; DOKLADY AKADEMII NAUK SSSR, No 6, Feb 86).. 19

Dispersion Equation for Plane Capillary-Gravity Wave on Free Surface of Viscous Incompressible Fluid
(P.N. Antonyuk; DOKLADY AKADEMII NAUK SSSR, No 6, Feb 86) 20

Underwater Exploration of Ampere Seamount on Research Vessel 'Vityaz'
(A. Gorodnitskiy; ZNANIYE - SILA, No 1, Jan 86)..... 20

Review of Recent Advances in Oceanography
(A.S. Monin; ZNANIYE - SILA, No 1, Jan 86)..... 20

Discussion of Reasons for Sea Level Fluctuations
(A.P. Lisitsyn; ZNANIYE - SILA, No 1, Jan 86)..... 21

Method for Determining Antenna Tilt Angles in Sonar Interferometer
(V.B. Vashchenko; GEODEZIYA I KARTOGRAFIYA, No 2, Feb 86)..... 21

Morphological-Statistical Objective Classification of Vertical Profiles of Hydrophysical Parameters
(I.M. Belkin; DOKLADY AKADEMII NAUK SSSR, No 3, Jan 86).. 22

Increasing Continuous Seismic Profiling Resolution in Research on Oceanic Sediments
(S. K. Dyukarev, G. A. Semenov, et al.; OKEANOLOGIYA, No 1, Jan-Feb 86)..... 22

Sea Hydrometeorological Measurement Complexes
(I.M. Shenderovich; OKEANOLOGIYA, No 1, Jan-Feb 86)..... 23

Influence of Surfactants on Damping of Gravity-Capillary Waves: I. Frequency Dependence
(A.A. Lazarev, K.V. Pokazeyev; OKEANOLOGIYA, No 1, Jan-Feb 86)..... 24

Intensive Synoptic Eddies and Quasigeostrophic Approximation
(Z.I. Kizner; OKEANOLOGIYA, No 1, Jan-Feb 86)..... 24

Dynamics of Isolated Intrathermocline Eddy
(G.I. Shapiro; OKEANOLOGIYA, No 1, Jan-Feb 86)..... 25

Application of Dynamic-Stochastic Model in Studying Heat Transfer in Hydrophyscal Test Range
(I. Ye. Timchenko, S.I. Khlopushina, et al.; OKEANOLOGIYA, No 1, Jan-Feb 86)..... 26

Defining 'Cavitation' and 'Cavitation Thresholds' Concepts
(M.A. Margulis; ZHURNAL FIZICHESKOY KHIMII, No 3, Mar 86)..... 26

Research on Sonoluminescence Mechanism. I. Onset Phase of Ultrasonic Luminescence of Fluid
(A.K. Kurochkin, Ye. A. Smorodov, et al.; ZHURNAL FIZICHESKOY KHIMII, No 3, Mar 86)..... 27

Influence of Secondary Eddy Currents on Scattering of Admixture in Zonal Flow
(V.N. Yeremeyev, L.M. Ivanov, et al.; IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA, No 1, Jan 86)..... 28

Influence of Relative Positioning of Optically Allowed and Forbidden $\pi\pi^*$ - Transitions on Spectral-Luminescent Properties of Organic Compounds
(G.V. Mayer; OPTIKA I SPEKTROSKOPIYA, No 1, Jan 86)..... 28

Polarization of Two-Photon Excited Fluorescence of Complex Organic Molecules in Vapors
(A.P. Blokhin, V.A. Povedaylo, et al.; OPTIKA I SPEKTROSKOPIYA, No 1, Jan 86)..... 29

Allowance for Influence of Triplet-Triplet Absorption When Using Optico-Acoustic Effect in Measurements of Quantum Yield of Luminescence from Highly Excited Molecular States
(A.A. Krasheninnikov, A.V. Shablya; OPTIKA I SPEKTROSKOPIYA, No 1, Jan 86)..... 30

Estonian Academy Head K. K. Rebane Saluted on 60th Birthday
(N. Kristoffel; SOVETSKAYA ESTONIYA, 11 Apr 86)..... 31

Studies of Thin Surface Films Aim at Seeing Deep Ocean Processes
(A. Zabotin; SOTSIALISTICHESKAYA INDUSTRIYA, 3 Apr 86)... 32

Marine Geology Expedition to Work Off Coast of Guinea
(Ye. Guzhva; PRAVDA UKRAINY, 24 Apr 86)..... 34

Specialists View Status of Ocean Hydrophysics Research
(VODNYY TRANSPORT, 19 Apr 86)..... 36

TERRESTRIAL GEOPHYSICS

New Seismogeophysical Observatory Installs Muon Telescopes
(SOVETSKAYA KIRGIZIYA, No 100, 20 Apr 86)..... 38

Laboratory Simulation of Seismic Events
(Domestic Service, 16 Mar 86)..... 39

Seismoacoustics Enhances Miners' Safety
(TASS, 18 Mar 86)..... 40

Earthquake Protection, Warning Systems for Nuclear Power Plants
(V. Musayelyan; KOMMUNIST, No 73, 23 Mar 86)..... 41

Geomagnetic Field Studies May Aid Prospecting, Communications
(SOVETSKAYA BELORUSSIYA, No 91, 19 Apr 86)..... 42

Continuing Work on EMP Probing of Earth With MHD Generators
(LENINSKOYE ZNAMYA, No 66, 16 Mar 86)..... 43

Field Studies of Earthquakes' Biological Precursor Phenomena
(V. Fremd; KAZAKHSTANSKAYA PRAVDA, No 79, 30 Mar 86)..... 45

Tidal Anomalies and Heat Flow in Western and Central Europe
(P. Melkhior, A.M. Sadovskiy; DOKLADY AKADEMII NAUK
SSSR, No 6, Feb 86)..... 47

Conditions for Magnetic Field Generation
(V.A. Dubrovskiy; DOKLADY AKADEMII NAUK SSSR, No 1,
Jan 86)..... 47

Natural Fuel Gases and Petroleum in Amur Region
(O.V. Ravdonikas, G.I. Ivanov; TIKHOOKEANSKAYA GEOLOGIYA,
No 6, Sep-Oct 85)..... 48

Role of Diagenesis in Formation of Ferromanganese Nodules in
Clarion-Clipperton Ore Province
(Ye.S. Bazilevskaya; TIKHOOKEANSAKAYA GEOLOGIYA, No 6,
Sep-Oct 85)..... 48

Gravity Field of Sea of Okhotsk Region and its Interpretation in Combination with Bathymetric and Seismic Data
(V. A. Baboshina, A.A. Tereshchenkov, et al.; TIKHOOKEANSKAYA GEOLOGIYA, No 6, Sep-Oct 85)..... 49

Deep Geoelectric Model of Southern Kamchatka
(Yu. F. Moroz; TIKHOOKEANSKAYA GEOLOGIYA, No 6, Sep-Oct 85)..... 50

Solution of Three-Dimensional Inverse Problem of Gravimetry in Contact Surfaces Class by Local Corrections Method
(I.L. Prutkin; IZVESTIYA AKADEMII NAUK SSSR: SERIYA FIZIKA ZEMLI, No 1, Jan 86)..... 50

Dynamics of Development of Long-Term Seismologic Precursors
(I.L. Nersesov, B.G. Rulev; IZVESTIYA AKADEMII NAUK SSSR: SERIYA FIZIKA ZEMLI, No 1, Jan 86)..... 51

PHYSICS OF ATMOSPHERE

Lasers Measure Atmosphere
(TASS, 27 Apr 86)..... 52

Specifics of Propagation of Radio Nuclides Discharged into Lower Layer of Atmosphere During Regeneration of Fuel Elements
(I.N. Ruzhentsova, R.V. Semova, et al.; ATOMNAYA ENERGIYA, No 5, Nov 85)..... 53

Thermophoresis of Spherical Aerosol Particle at Arbitrary Knudsen Numbers
(S.A. Beresnev, V. G. Chernyak; DOKLADY AKADEMII NAUK SSSR, No 6, Dec 85)..... 53

Theory of Heat and Moisture Exchange Between Finely Disperse Storm-Generated Spray and Turbulent Air Flow
(Ye. P. Borisenkov, M.A. Kuznetsov; IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA, No 11, Nov 85)..... 54

Specific Features of Multiple Counting of Particles by Photoelectric Counters
(Yu. V. Zhulanov, A.A. Lushnikov, et al.; IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA, No 11, Nov 85)..... 54

Multiwave Laser Soundings of Atmospheric Aerosol: Experimental Research (Review)
(A.P. Chaikovskiy; ZHURNAL PRIKLADNOY SPEKTROSKOPII, No 2, Feb 86)..... 55

Us of Electron Beam Instruments to Determine Fluctuations in Vertical Refraction Partial Angle
(A.S. Kolos; GEODEZIYA I KARTOGRAFIYA, No 2, Feb 86)..... 55

Lidar-Radiometric Method for Determining Liquid-Water Content of Cirrus Clouds
(V.A. Zhuravleva, O.K. Kostko; IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA, No 1, Jan 86)..... 56

Absorption of Far IR-Radiation by $H_2O$-$N_2$ Complexes Under Atmospheric Conditions
(A.A. Vigasin, G.V. Chlenova; IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA, No 1, Jan 86)..... 56

Structure of Stably Stratified Atmospheric Surface Layer in Presence of Heat-Releasing Admixture
(L. Kh. Ingel; IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA, No 1, Jan 86)..... 57

Considering Refraction in Leveling with Laser Plane
(Yu.S. Galkin, G.G. Pobedinskiy; GEODEZIYA I KARTOGRAFIYA, No 2, Feb 86)..... 58

ARCTIC AND ANTARCTIC RESEARCH

Plans for Evacuating Arctic Station "SP-26", Opening "SP-28"
(S. Nikonov; LENINGRADSKAYA PRAVDA, No 63, 3 Mar 86)..... 59

More on Plans for Antarctic Research Vessel 'Akademik Fedorov'
(VODNYY TRANSPORT, No 47, 19 Apr 86)..... 60

Site Selected for Future Arctic Station "SP-28"
(A. Ryabushev; IZVESTIYA, No 86, 27 Mar 86)..... 62

AN-74 Airplane Landed on 600-Meter Runway on Ice Floe
(V. Snegirev; KOMSOMOLSKAYA PRAVDA, No 64, 15 Mar 86).... 63

Head of Arctic Ski-Hiking Group Comments on Experiences
(G. Alimov; IZVESTIYA, No 88, 29 Mar 86)..... 64

Plans for Airlift Drop of Personnel and Cargo at Arctic Station
(S. Nechayuk; KRASNAYA ZVEZDA, No 88, 11 Apr 86)..... 65

Dissipation of Mechanical Energy in Ice
(V.A. Fomin, V.N. Rodionov; DOKLADY AKADEMII NAUK SSSR, No 6, Dec 85)..... 66

Water Freezing and Ice Melting in Disperse Rocks
(E.D. Yershov; VESTNIK MOSKOVSKOGO UNIVERSITETA, SERIYA 4: GEOLOGIYA, No 1, Jan-Feb 86)..... 66

METEOROLOGY

# COMPUTER MODELING AIDS STUDIES OF PRECIPITATION FORMATION

IZVESTIYA, 23 Mar 86, No 82 (21524), p 3

[Article by V. Korneyev, correspondent (Dolgoprudnyy, Moscow Oblast)]

[Abstract] On the occasion of World Meteorology Day, this article records a conversation with Doctor of Physical-Mathematical Sciences S. M. Shmeter, head of the department of cloud physics and atmosphere dynamics of the Central Aerological Observatory (TSAO) of the State Committee for Hydrometeorology and Environmental Control. Shmeter comments on directions of cloud-physics research which is in progress at this observatory and on methods which are being used in this research.

Shmeter relates that scientists of TSAO are now working on a number of unsolved problems of cloud and precipitation formation. They seek, in particular, to determine the ratio of ice crystals to cloud volume which is optimal for the formation of precipitation. Methods which are being used in this research include both field observations and laboratory experiments, including digital modeling of clouds with the aid of computers. Such experiments have been necessitated by the complexity of measurements which must be made inside clouds and the limited capabilities of equipment which is now available for this purpose, Shmeter explains. Characteristics of cloud particles are now being recorded with the aid of whole instrument-complexes on board laboratory airplanes, for example. However, airborne equipment alone cannot provide all of the information which researchers need on physical processes inside clouds. Shmeter reports that computer modeling has made it possible to clarify many aspects of precipitation-formation processes in extensive cloud fields associated with cyclones, for example.

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PROGRESS IN IMPROVING WEATHER FORECASTING VIEWED

NEDELYA, 30 Dec 85, No 1 (1345) p 23

[Article by Andrey Pralnikov (interviewer)]

[Abstract] In an interview, Aleksandr Aleksandrovich Vasilyev, director of the USSR Hydrometeorological Scientific Research Center, comments on weather monitoring and forecasting methods that are now in use, progress in heightening the accuracy of forecasts, and work aimed at improving long-term forecasting.

Vasilyev notes that the weather service is one of the country's most active users of computer technology. He reports that short-term weather forecasting has become substantially more accurate thanks to the introduction of computer-aided processing of data gathered by ground and aerospace observation equipment. Modern computers make it possible to predict processes of circulation in the atmosphere for five to seven days in advance; one-month forecasts are now being made with a reliability of about 65 percent, Vasilyev claims. The accuracy of long-term forecasting can and will be heightened still further, through more extensive use of satellite information, for example, but Vasilyev observes that each percent of gain in accuracy is achieved with more and more difficulty. Computers with speeds of billions of operations a second are needed for processing if the network of satellite-aided weather observations is to be expanded.

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# NEW PRECIPITATION MAP OF WORLD OCEAN

Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA GEOGRAFICHESKAYA in Russian
No 1, Jan-Feb 86 (manuscript received 25 May 85) pp 37-49

[Article by E. G. Bogdanova, Main Geophysical Observatory imeni A. I. Voyeykov]

[Abstract] During recent years great amounts of data have become available concerning precipitation over the world ocean, dictating revision of maps published in past years. Accordingly, maps of the quantity and intensity of precipitation over the oceans (except for the Arctic and Antarctica) have been compiled. A new method was employed. Their reliability was evaluated by comparison with corresponding data obtained by independent methods. The maps were analyzed in order to clarify new distribution patterns or details. Only directly collected data were used; no data were extrapolated from islands or the mainland. The computation parameters used were temperature, wind and humidity; the distribution of precipitation fully corresponds to the patterns of atmospheric circulation and ocean currents. Since calculations of the quantity and intensity of precipitation were made at the level of their monthly values, any characteristics of their intra-annual variability can be obtained. The computation procedures used were simple, particularly in comparison with the unwieldy processing method used by G. B. Tucker in 1961. The accuracy of the new maps is somewhat compromised by errors in the indirect computation of intensity and determination of duration using data on the frequency of recurrence of precipitation. The accuracy of the maps appears to be identical with the accuracy of the maps published by C. E. Dorman and R. H. Bourke (which, however, lacked a map for the Indian Ocean) in QUART. J. ROYAL METEOROL. SOC., Vol 104, No 441, p 765, 1978. Figures 4; references 28: 12 Russian, 16 Western.

DROUGHT, SOLAR ACTIVITY LINK ESTABLISHED BY LENINGRAD GEOPHYSICISTS

Moscow TASS in Russian 1115 GMT 28 Feb 86

[Abstract] Moscow, 28 February [TASS]. Scientists of the Main Geophysical Observatory in Leningrad have succeeded in establishing a link between extreme weather conditions and solar activity, it was announced today by the Moscow newspaper GUDOK. The main subject is droughts, whose distribution is related to solar activity cycles. For some regions of the earth a 22-year cycle applies, and for others, including the USSR, an 11-year cycle. Even though people cannot avert droughts, by knowing when they are due to begin they can prepare for them.

## ELECTROMAGNETIC DESALINATING AND OIL CLEAN-UP METHOD

Alma-Ata KAZAKHSTANSKAYA PRAVDA, 18 Mar 86 p 3

[Text] Guryev--Scientists of the Kazakh Academy of Sciences' Institute of the Chemistry of Petroleum and Natural Salts have decided to utilize electromagnetic fields' capability of retaining certain substances for the purpose of removing water from petroleum.

"Water is pumped into wells for the purpose of increasing the output of oil pools," said Candidate of Chemical Sciences L. Borodkin, one of the developers of this new process. "But if this water gets into pipelines, it makes preparation much more complicated and expensive. We proposed ridding oil of this impurity while it is being piped. Sections made up of several electrodes and forming a kind of sieve were installed in pipelines for this purpose. This device retains negatively charged water through the force of electromagnetic fields."

Unlike previously developed units, the new one's principle of operation does not require chemical preparations or costly equipment. It makes it possible to purify petroleum without interrupting its pumping.

The scientists' research is useful also for solving ecological problems: slicks of various petroleum products can be eliminated from the surfaces of bodies of water by using the same principle of electric filtration. The units are also suitable for desalinating water.

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AIRBORNE LASER FLUORIMETER FOR DETECTING WATER POLLUTION

Moscow VODNYY TRANSPORT, 28 Dec 85 No 156 (8963), p 4

[Article by M. Yeremyants]

[Text] A laser beam invisible to the eye touched an oil slick on the surface of water. The beam was reflected instantly from the water, and information on the degree of pollution of the water was recorded on the screen of a video terminal. This is how a new instrument operates. It is a fluorimeter which has been developed by scientists of Yerevan University, and of a laboratory of the Yerevan Special Design and Technological Bureau of Aerosol Instruments and Catchers of the USSR State Committee for Hydrometeorology and Environmental Control.

The instrument's operating principle is fairly simple: the reflected beam is split up, so to speak, into 16 'colors' of the visible frequency range. They bear data on the content of impurities and of organic substances in the water and on the plant life of bodies of water, for example, and this information is subsequently processed by a microcomputer.

The instrument reacts sensitively to impurities located at distances as great as 200 meters from it. It can be used successfully for probing rivers, lakes and seas from a helicopter or airplane.

The fluorimeter passed tests successfully at the Klaypeda Hydrometeorological Observatory in the course of studies of the Baltic Sea.

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RESEARCH SHIP 'NESMEYANOV' HEADS FOR VIETNAM COAST

Moscow TRUD 17 Jan 86 p 4

[Arricle by Yu. Yudin]

[Text] Vladivostok--The research ship "Akademik Aleksandr Nesmeyanov" has set out from Vladivostok on its first cruise of this year. The ship of science is heading for the coast of Vietnam.

On board is a large expedition of specialists of the Institute of Marine Biology of the USSR Academy of Sciences' Far East Research Center. They will soon be joined by colleagues from the fraternal republic's Institute of Marine Research. For three months, the international team will be working in the South China Sea. The Soviet and Vietnamese scientists will study the ecology and biochemistry of marine organisms and will attempt to find an answer to the question of what animals inhabit the coastal coral reefs of Vietnam and in what numbers. Other studies, pertaining to the utilization of marine animals and plants valuable to man, will also be conducted.

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HEATED DIVING SUIT FOR OFFSHORE OIL RIG WORKERS

Moscow NEDELYA, 30 Dec 85-5 Jan 86, No 1 (1345), p 5

[Article by Yu. Anatolyev (Kharkov)]

[Text] Intensive development of gas and oil fields of the continental shelf has necessitated the development of effective underwater gear which is capable of ensuring the life support and safety of divers at comparatively great depths. Under the direction of G. N. Kucherenko, V. G. Komarenko and V. A. Skrebitskiy, specialists of the Ukrainian Affiliate of the All-Union Scientific Research Institute of the Offshore Petroleum and Gas Industry have developed a diving complex which is the first of its kind in Soviet practice. It has reliable life-support systems: breathing apparatus, communications equipment, and heat generating unit. The suit itself is original, and it is even comfortable for divers. Some of its design solutions are protected by certificates of invention. The new diving suit's technical parameters match those of the best foreign models. Tests of the suit are now in progress.

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COMPLEX FOR OCEAN STUDY FROM SPACE AND HYDROACOUSTIC STATIONS

Tallinn SOVETSKAYA ESTONIYA, 18 Feb 86 p 1

[Text] The ocean is a constant object of scientists' attention, because it possesses vast food, energy and mineral resources.

Of special interest are the seas of the Far East which wash the eastern boundaries of the Soviet Union--the Japan, Okhotsk and Bering seas. Timely questions of the study and exploitation of the ocean and its resources are thus important ones for the USSR Academy of Sciences' Far East Research Center, and especially for the Institute of Automation and Control Processes (IAPU) and its computer center. In collaboration with other academy and industry institutes of the region, IAPU is working on the development of information support for oceanological research.

In particular, research is being done on principles of remote study of the ocean from space stations and hydroacoustic stations. In connection with this, the development of a software-hardware complex called DISTERM is being completed; it is intended for automated gathering, storage and processing of data of hydrometeorological observations made on ships and satellites. A copy of this complex has been installed on the scientific research ship "Akademik Sergey Korolev", where experiments with its operation are being conducted. The use of the DISTERM software-hardware complex is expected to provide information which scientists, weather forecasters and fishermen need quickly.

(A photograph is given showing Candidate of Physical-Mathematical Sciences M. F. Ivanov, head of a department, and junior research associate N. V. Aleksandrova and researcher-trainee I. A. Goncharenko analyzing photographs and data from the DISTERM complex.)

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SEA PROVIDES HEAT FOR DWELLINGS

Moscow TASS in English 27 Apr 86

[Text] An unusual power station has gone into operation in Yalta (the Crimean Peninsula). With a capacity of more than two megawatts, it draws heat directly from the Black Sea to warm dwellings.

Even in low winter temperatures the sea possesses tremendous heat reserves. It takes only skill to transform it into high potential heat. Refrigerating machines are used for the purpose. Every hour two pumps send through special pipes up to 500 cubic meters of sea water. Despite relatively low temperature, the gas freon, on contact with the pipes, starts boiling. After this the freon vapors are squeezed by compressors and thus heated to 100-110 degrees. It is this heat which is finally used to warm dwellings.

In summer the pumps could be used for air-conditioning. Of particular importance is the fact that such a method of heating is ecologically pure, safe and economical.

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COMPUTER-AIDED STUDIES OF TSUNAMI ZONES ON PACIFIC COAST

Moscow TRUD 14 Mar 86 p 4

[Abstract] The article is an interview with Yu. Shokin, corresponding member of the USSR Academy of Sciences and director of the Academy's Krasnoyarsk Computer Center. Shokin comments on results of studies which specialists of this center have been making of tsunami movement patterns and hazards in the Soviet Far East, using mathematical modeling methods.

Tracing the history of this work, Shokin recalls that it began with studies of tsunamis which were initiated by Academician Lavrentyev and carried on by a group of young scientists of the computer center and Institute of Theoretical and Applied Mathematics of the USSR Academy of Sciences' Siberian Department. Three years ago, Shokin and his colleagues moved to Krasnoyarsk, where a new laboratory, "Mathematical Methods for Computer Experiments", was set up. With the aid of computers, the formation and behavior of tsunamis was calculated, effects produced by tsunamis on particular sections of the land were studied, and a unique map of wave movements was compiled for the Pacific coast. Calculations have been made of tsunamis' likelihood of occurrence at various points on the coast and in the Kuril Islands, and high-risk and low-risk sectors have been indicated on maps. Comprehensive programs which the Krasnoyarsk scientists have developed for determining tsunami zones reportedly are considered the best in the country. The accuracy of the scientists' theoretical calculations has been verified, using data on tsunamis which occurred in Japan in 1983, Shokin relates.

Shokin mentions in conclusion that he and his colleagues have reported on specific problems of their work in the United States and a number of other countries. A contract has been concluded with UNESCO's International Oceanographic Commission, in line with which the Krasnoyarsk scientists are to compile a map of tsunami movements for all of the countries of the Pacific region.

FTD/SNAP
/9716
CSO: 1865/303

MONOGRAPH ON PROSPECTIVE DEVELOPMENTS IN OCEANOLOGY

Moscow NTR: PROBLEMY I RESHENIYA, 4-17 Mar 86 No 5, p 8

[Abstract] The article consists of excerpts from a chapter of a monograph, "Oceanology in the Year 2000" (Okeanologiya v 2000 godu), which has been prepared for publication at the USSR Academy of Sciences' Oceanology Institute. The author of this chapter is A. S. Monin, corresponding member of the USSR Academy of Sciences and director of the Oceanology Institute. The monograph is said to be the collective work of a group of specialists. They extrapolate current trends in oceanology and forecast advances which are expected in this field by the turn of the century. Monin views prospective developments of oceanology and oceanology-related R&D in five areas: physics, geology, biology, technology and expedition research. Mention is made, in particular, of promising directions of work and advances which are anticipated in computer-aided hydrodynamics research and long-range weather forecasting, communication with dolphins in their own language and development of underwater surveying equipment and submersible craft.

FTD/SNAP
/9716
CSO: 1865/303

UDC: 532.592

THREE-DIMENSIONAL CAUCHY-POISSON PROBLEM FOR AREA OF VARIABLE DEPTH

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 286, No 2, Jan 86 (manuscript received 30 Jan 85) pp 321-323

[Article by A. A. Dorfman]

[Abstract] A full system of eigenfunctions if found for the 3-dimensional linearized problem of unsteady wave motion of a fluid in a basin with flat sloping bottom. It is demonstrated that the system includes a finite number of discrete spectrum functions describing the shore waves. One component of this group is known as the Stokes wave. The shore waves which close the system represent a boundary effect. The completeness of the system allows construction of a precise solution to the problem of wave motion of the fluid in response to disturbances of arbitrary form for a range of bottom angles. References 5: Russian.

UDC: 551.35

NEW DATA ON GEOLOGY OF YAP AND CENTRAL FAULTS IN PHILIPPINE SEA

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 286, No 2, Jan 86 (manuscript received 14 Feb 85) pp 417-421

[Article by S. A. Shcheka, R. G. Kulinich, S. V. Vysotskiy, V. G. Sakhno, A.I. Khanchuk, V. T. Syedin, and S. P. Pletnev, Far Eastern Geology Institute; Far Eastern Scientific Center, USSR Academy of Sciences, Vladivostok]

[Abstract] During the third cruise of the research vessel "Akademik Aleksandr Vinogradov," 3 Mar-22 May 1984, studies were made of the largest faults in the eastern and western portions of the Philippine Sea. A full collection of rocks of the ophiolitic association was dredged up from the eastern trench and basaltoids with specific geochemical characteristics were brought up for the first time. In the western fault rock materials were obtained for the first time and a significant alkaline-basaltic volcanic structure was found. The structure of the two faults is described. The data obtained indicate that in the deeper sections of these faults there are Precenozoic rocks of the

ophiolitic association--oceanic tholeiites-gabbroids-hyperbasites, similar to the rocks of the intraoceanic rifts. The Eocene-Oligocene volcanic cover consists of oceanic tholeiites, somewhat enriched in Ti, Zr and Rb, while preserving the oceanic level of content of Ni, Cr and Ba. This may represent the geochemical signature of magmas from the initial stages of oceanization of the crust of the boundary seas. Figures 2; references 3: 1 Russian, 2 Western.

UDC: 550.311

HEAT FLOW AND GEODYNAMIC MODEL OF WESTERN PACIFIC OCEAN TRANSITION ZONE

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 286, No 2, Jan 86 (manuscript received 24 Apr 85) pp 324-328

[Article by V.I. Ilichev, academician, and Yu.V. Shevaldin, Pacific Ocean Oceanological Institute; Far Eastern Scientific Center, USSR Academy of Sciences, Vladivostok]

[Abstract] A number of peculiarities in the structure of the Western Pacific Ocean transition zone heat flow are discussed and an attempt is made to construct a geodynamic model of the zone which neither neglects nor disagrees with factual data observed in the area. Areas of the deep water trenches and their heat flows are compared. The structure of the heat flow is found to correlate with residual gravitational anomalies previously calculated on the assumption of density anomalies in the upper mantle. The stages of formation of the zone are discussed. Figures 3; references: 5 Russian.

UDC: 551.465.15:628.5

CALCULATION OF SPATIAL DISTRIBUTION OF DISSOLVED PETROLEUM HYDROCARBONS IN TIDAL ESTUARY

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 285, No 6, Dec 85 (manuscript received 19 Feb 85) pp 1447-1450

[Article by V.V. Anikiyev and O.V. Zaytsev, Pacific Ocean Oceanology Institute, Far Eastern Scientific Center, USSR Academy of Sciences, Vladivostok]

[Abstract] A description is presented of a stochastic model of the propagation of dissolved and dispersed petroleum hydrocarbons in one tidal region of the littoral zone of the sea. The region used in the model is shallow, the area of homogeneous mixing extending to the bottom, making the problem 2-dimensional. Dynamic fields were computed using data from 60 buoy stations with type BVP-2 automatic current recorders. The model considers absorbtion of hydrocarbons at the shoreline and by bottom sediments. The model also allows introduction of certain hydrologic fields influencing the rate of oxidation of the hydrocarbons. Figure 1; references 6: 4 Russian, 2 Western.

UDC: 517.946

CAUCHY PROBLEM FOR LINEARIZED SYSTEM OF NAVIER-STOKES EQUATIONS CONSIDERING COMPRESSIBILITY

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 285, No 6, Dec 85 (manuscript received 19 Mar 85) pp 1374-1376

[Article by A. K. Shatov, Moscow State University imeni M. V. Lomonosov]

[Abstract] A study is made of a compressible fluid whose physical characteristics remain constant with time. The conditions at infinity for the equations describing the Cauchy problem must be formulated so that they provide a unique solution to the Cauchy problem. This question is discussed. Convergence of the solution of an equation derived in this article to the solutions of other equations as v and g approach 0 is proven, thus demonstrating convergence of the solutions of the original system of equations to the solutions of a degenerate system. References 5: Russian.

UDC: 532.516.5

ASYMPTOTIC FORM OF STATIONARY SOLUTIONS OF THE NAVIER-STOKES EQUATIONS FOR LARGE REYNOLDS NUMBERS

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 285, No 6, Dec 85 (manuscript received 20 Nov 84) pp 1353-1355

[Article by S.I. Chernyshenko, Mechanics Institute, Moscow State University imeni M.V. Lomonosov]

[Abstract] Internal noncontradictory asymptotic expansions of the solutions to the Navier-Stokes equations have not yet been constructed for cases in which the flow includes discontinuous zones whose dimensions are comparable to the characteristic scale of the entire flow. The nonexistence of solutions at large Re numbers might at first make asymptotic analysis seem senseless. However, the class of functions in which a solution can be found can be expanded. Extending results achieved in a work by Stewartson, the author discusses the behavior of the flow at angles of attack beyond the critical angle. The results obtained indicate that in the class of complex functions it is possible to construct an internally noncontradictory asymptotic expansion of the stationary solutions of the Navier-Stokes equations in certain cases in which attempts to construct a real-valued expansion are unsuccessful. Figure 1; references 4: 3 Russian, 1 Western.

UDC: 551.461

STEADY DISTORTION OF SHAPE OF GEOID AND NORMAL GRAVITY FIELD UNDER INFLUENCE OF TIDAL POTENTIAL

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 285, No 6, Dec 85 (manuscript received 11 Mar 85) pp 1356-1359

[Article by S.S. Ivanov, Oceanology Institute imeni P.P. Shirshov, USSR Academy of Sciences, Moscow]

[Abstract] An expression is studied for the tidal potential. Expressions for the diurnal and semidiurnal components of the tidal potential include the cosines of the single and double hour angle of the star, causing their mean value to equal zero over the period of rotation. This is not the case for the long-period tidal potential. The distortion is computed to be about 10 cm at the equator, 20 cm at the poles, and 0 and $\pm$ 35.16°. The full amplitude of steady distortion of the normal gravity field of the earth due to the long-period tidal potential is approximately 0.2 mGal. References 9: 8 Russian, 1 Western.

UDC 551.465.15

EXPERIMENTAL STUDY OF TURBULENT DIFFUSION PARAMETERS IN OCEAN

Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA in Russian Vol 21, No 11, Nov 85 (manuscript received 14 Jun 83, after revision 18 May 84) pp 1226-1229

[Article by V.V. Anikiyev, O. V. Zaytsev, T. V. Zaytseva and V.V. Yarosh, Pacific Ocean Oceanological Institute, USSR Academy of Sciences]

[Abstract] In research on turbulent diffusion in the ocean carried out in the Black Sea, Baltic Sea, North Sea and in the Atlantic Ocean it was impossible to deduce any universal laws of development of spots or streams of tracers being used to ascertain patterns of turbulent diffusion. In each case these patterns are highly dependent on hydrometeorological and morphometric parameters. A dependence of rate of expansion of such spots on wave height and velocity of the mean current was noted. Bottom relief, shore configuration and structure of currents exert a marked influence on spot configuration in coastal and shallow-water areas. In coastal waters of Japan, China and South Korea tidal currents are also a highly important factor. The same is true of monsoons, passage of typhoons and powerful currents. All these factors were taken into account in studying the laws of turbulent diffusion in the coastal region of the Sea of Japan and in the open part of the Pacific Ocean by release of dye. Spot evolution was investigated using an aerial photograph survey and a submersible fluorometer towed at a depth of 1.5-2 m. The parameters determined were: longitudinal and transverse dimensions of spot; spot area and anisotropy; azimuth of longitudinal axis. The law of increase

in effective area with time obtained earlier for the coastal zone was confirmed, but the increase in anisotropy was slower (all observations were made under identical hydrometeorological conditions). The role of velocity gradients in spot diffusion was less in the tropical parts of the ocean than in coastal zones. However, there is a universal dependence $S^* \sim t^{2.3}$ in both the coastal zone and in the open ocean, confirming the results obtained by A. Okubo (DEEP-SEA RESEARCH, Vol 18, No 8, pp 789-802, 1971). Figures 2; references: 12: 4 Russian, 8 Western.

UDC 551.464.34

INFLUENCE OF STRATIFICATION IN NEAR-SURFACE WATER LAYER ON INTENSITY OF GAS EXCHANGE BETWEEN ATMOSPHERE AND WATER

Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA in Russian
Vol 21, No 11, Nov 85 (manuscript received 19 Mar 84) pp 1198-1205

[Article by V. F. Brekhovskikh and V.I. Bratkov, Water Problems Institute, USSR Academy of Sciences]

[Abstract] Little is known concerning the influence of the temperature field in the near-water layer on gas exchange between the atmosphere and water. During periods of calm the transfer of oxygen from the air to water is sometimes impeded and large numbers of fish may die. A laboratory experiment was carried out in glass thermostated containers, in each of which the temperature was maintained with great accuracy. One was heated to 39-40°C; another was cooled to 12-13°; a third was kept at ambient temperature. In each case the aeration coefficient and rate of mass transfer were computed. Air and water temperatures were varied to determine temperature gradients in the near-water and near-surface layers. A copper-constantan thermocouple was used in measuring temperatures above and below the interface. The influence of petroleum films on the rate of mass transfer was also determined; various varieties of petroleum were used. The rate of evaporation at different temperatures was ascertained. The greatest influence was observed in experiments with cooled air. It was found that temperature stratification in the near-surface water layer exerts a considerable influence on water-air gas exchange. In certain cases a petroleum film increases the temperature gradient and causes an even greater decrease in mass transfer rate. Figures 2; references 18: 12 Russian, 6 Western.

UDC 550.345

## PHYSICAL INTERPRETATION OF LAW OF FREQUENCY OF RECURRENCE OF TSUNAMI HEIGHTS

Moscow VULKANOLOGIYA I SEYSMOLOGIYA in Russian No 1, Jan-Feb 86 (manuscript received 12 Jun 84) pp 85-90

[Article by R. Kh. Mazova, Ye. N. Pelinovskiy and A. A. Poplavskiy, Sakhalin Complex Scientific Research Institute, Far Eastern Scientific Center, USSR Academy of Sciences]

[Abstract] The following factors governing the law of frequency of recurrence of heights of tsunamis at the coastline were examined in detail: frequency of earthquakes causing tsunami waves of a particular height in a particular region, conditions for generation and propagation of waves (including runup) and observation conditions. A simple model example was employed for clarifying these factors, with emphasis on their propagation conditions. The problem is examined for a basin of constant depth with a linear coastline. It is recognized that the general law may be in need of modification due to such factors as the presence of alongshore waveguides and differences in conditions for the runup of tsunami waves on the coast. However, new formulas were derived which make it possible to ascertain an upper evaluation of the law of frequency of recurrence of tsunami wave heights in any particular region, assuming availability of detailed observations of manifestations of at least one very strong tsunamigenic earthquake in the particular region and information on the number of tsunamigenic earthquakes during a given time interval. These same formulas make it possible to obtain realistic estimates of frequency of recurrence in any region of large (8-10 m) tsunami heights. Figures 5; references 10: 9 Russian, 1 Western.

UDC: 550.4

## MANGANESE ACCUMULATION IN FLUID PHASES INTERACTING WITH ROCKS OR MELTS

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 286, No 1, Jan 86 (manuscript received 12 Mar 85) pp 194-196

[Article by V. F. Geletiy, Geochemistry Institute imeni A. P. Vinogradov, Siberian Department, USSR Academy of Sciences, Irkutsk]

[Abstract] A study is made of factors which determine the manganese-iron ratio in fluids in equilibrium with silicate phases, including temperature, pressure, salt composition and pH of fluid systems, as well as the type and composition of the rock or melt and fluid/rock ratio. The temperature at which the fluids interact with the silicate phases is the determining factor influencing the transition of manganese and iron into solution. The Mn/Fe ratios in fluids interacting with melts or rocks at about 1000°C coincide with values for basic types of rock, indicating that there is no fractionation of these elements at this temperature, both elements making the transition to supercritical aqueous solutions in the same ratio in which they are present in the silicate phases.

The separation of manganese and iron upon interaction of the elements with oxygen under conditions such as those near the surface or in the sulfide stage in the hydrothermal process may occur under endogenous conditions in aqueous solutions due to the differing stability of manganese and iron complexes. References 15: 10 Russian, 5 Western.

UDC 551.464.3:551.510.4

STUDY OF CONTENT OF TRACE ELEMENTS IN MARINE AEROSOLS AND SURFACE MICROLAYER OF SEA

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 286, No 6, Feb 86 (manuscript received 9 Apr 85) pp 1348-1351

[Article by V.D. Korz[illegible], Oceanology Institute imeni P.P. Shirshov, USSR Academy of Sciences, Moscow

[Abstract] The purpose of this research was to determine the possibility of studying the content of trace elements in the surface microlayer of sea water by determining their concentration in marine aerosols. A surface layer sampler similar to the bubble interfacial microlayer sampler, called the "Mikrookean" instrument, was used for the first time in this work. The device can be used on board a ship at cruising speed in any weather. It works by raising a sample of water which is poured into the glass cylinder of the device; then purified air is bubbled through it, forming an aerosol, which is then collected on plates. Figure 1; references 10: 3 Russian, 7 Western.

UDC 532.592

NONLINEAR WAVES ON SURFACE OF FLUID LAYER WITH CONSTANT VORTICITY

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 286, No 6, Feb 86 (manuscript received 21 Nov 85) pp 1332-1336

[Article by V.I. Shrira, Oceanology Institute imeni P.P. Shirshov, USSR Academy of Sciences, Moscow]

[Abstract] A description of the evolution of nonlinear waves on the surface of a layer of fluid with constant vorticity is presented. A variational formulation of the initial equations for its dynamics is given. Situations in which weak nonlinearity is essential are determined. An symptotic procedure is used to obtain evolutionary equations describing the propagation of waves under such conditions. References 11: 3 Russian, 8 Western.

UDC 532.59

## DISPERSION EQUATION FOR PLANE CAPILLARY-GRAVITY WAVE ON FREE SURFACE OF VISCOUS INCOMPRESSIBLE FLUID

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 286, No 6, Feb 86 (manuscript received 28 Dec 84) pp 1324-1328

[Article by P.N. Antonyuk, Moscow Higher Technical School imeni N.E. Bauman]

[Abstract] A parametric representation is obtained at a dispersion equation for a plane capillary-gravity wave on the free surface of a viscous incompressible fluid in real form, allowing exhaustive investigation of the influence of viscosity on plane capillary-gravity waves. The existence of both periodic and aperiodic modes, alternating at a certain critical wavelength, is established. Figures 2; references 9: 5 Russian, 4 Western.

## UNDERWATER EXPLORATION OF AMPERE SEAMOUNT ON RESEARCH VESSEL 'VITYAZ'

Moscow ZNANIYE - SILA in Russian No 1, Jan 86 pp 33-36

[Article by A. Gorodnitskiy, doctor of geological-mineralogical sciences]

[Abstract] The seventh cruise of the scientific research vessel 'Vityaz' was dedicated to the study of underwater volcanoes, particularly Ampere Seamount. The expedition returned to a site on the seamount where formations had been seen which looked very much like walls, dikes, gates and rooms of rock assembled by humans. Further studies revealed that the "walls" and "dikes" were natural formations of rock associated with cracks in the extinct volcano which happened to be at right angles to each other, giving the appearance of walls laid out in regular rectangles. It is concluded that these are natural formations, and that Ampere is not the location of the legendary lost city of Atlantis. Figures 4.

## REVIEW OF RECENT ADVANCES IN OCEANOGRAPHY

Moscow ZNANIYE - SILA in Russian No 1, Jan 86 p 3

[Article by A.S. Monin, corresponding member, USSR Academy of Sciences, Director, Oceanology Institute imeni P.P. Shirshov, USSR Academy of Sciences]

[Abstract] A.S. Monin discusses some recent advances in oceanography including the discovery of small-scale eddies accompanying ocean currents, the discovery of sulfide-based ores richer than manganese nodules and lying at shallower depths in the rift zones of the mid-ocean ridges, the use of divers to perform useful work at depths of up to 400 meters and the anticipation that divers will be able to work at over 600 meters. Predicting the future, Monin foresees

extraction of greater quantities of useful minerals from the ocean, great reductions in pollution of ocean water, improvements in marine weather forecasting to allow messages to be transmitted to ships instructing them to change course to avoid dangerous weather phenomena and the discovery of large quantities of petroleum in arctic waters north of the Soviet Union.

DISCUSSION OF REASONS FOR SEA LEVEL FLUCTUATIONS

Moscow ZNANIYE - SILA in Russian No 1, Jan 86 pp 14-16

[Article by Aleksandr Petrovich Lisitsyn, corresponding member, USSR Academy of Sciences]

[Abstract] This discussion between A.P. Lisitsyn and a nameless correspondent is related to the All-Union School of Marine Geology which is to hold its next meeting in April of 1986 at Gelendzhik. The topic discussed is the fluctuations which have occurred in sea level through geological time. Global changes in sea level over the past are graphed, as are the locations of the coastline in South Africa and Western Australia. Possible causes of past very low sea levels are noted: tectonic movements and changes in the nature of water exchange on the surface of the earth. Studies of the content of microscopic animals in sediments can indicate the salinity of the ocean in the past, thus indicating whether changes in ocean level were caused by tectonic movements or glaciation-related changes in water exchange. Figures 5.

UDC 528.06:[528.47:551.462.32]

METHOD FOR DETERMINING ANTENNA TILT ANGLES IN SONAR INTERFEROMETER

Moscow GEODEZIYA I KARTOGRAFIYA in Russian No 2, Feb 86, pp 30-34

[Article by V.B. Vashchenko]

[Abstract] A study was made of a method for determining the tilt angle of interferometer antennas by investigating the interference pattern from a sonar image by means of spectral correlation analysis. The method is based on the fact that in general each interference line is acted upon differently by the relief, whereas the antenna fluctuation effect is identical for all lines. Assuming that the sonar lines defining the bottom relief are smoother than the antenna oscillations, it is possible to isolate the high-frequency portion of these oscillations on the interferogram. By then solving the equations describing these oscillations it is possible to estimate the tilt angles of the antennas. Use of the method allows production of interferograms of the bottom with the required accuracy over the entire width of the diagrams. Figures 3; references 7: 4 Russian, 3 Western.

UDC 551.46.07/08

## MORPHOLOGICAL-STATISTICAL OBJECTIVE CLASSIFICATION OF VERTICAL PROFILES OF HYDROPHYSICAL PARAMETERS

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 286, No 3, Jan 86 (manuscript received 12 Oct 84) pp 707-711

[Article by I.M. Belkin, Oceanology Institute imeni P.P. Shirshov, USSR Academy of Sciences, Moscow]

[Abstract] Objective and effective methods are needed to analyze the vertical structure of the ocean. The authors have developed a method of objective classification of characteristic vertical hydrophysical profiles for this purpose. The method is based on the theory of pattern recognition, and uses as its major principle and the first stage in classification the classification of vertical profiles based on form, a so-called morphological classification. The form of a profile is assigned on the basis of its set of singular points, considered by definition to be the extremes of a function or hydrophysical parameter and its first two derivatives. The morphological profile classification process is reduced to classification of the vectors of singular points consisting of codes. The method has been implemented as a software system and tested on a file of 290 mean long-term 50 vertical salinity profiles in the North Pacific, revealing good agreement with the results of expert classifications and indicating the effectiveness of the method. Figures 3; references 14: 12 Russian, 2 Western.

UDC 551.462

## INCREASING CONTINUOUS SEISMIC PROFILING RESOLUTION IN RESEARCH ON OCEANIC SEDIMENTS

Moscow OKEANOLOGIYA in Russian Vol 26, No 1, Jan-Feb 86 (manuscript received 4 Oct 83, after revision 27 Apr 84) pp 144-150

[Article by S. K. Dyukarev, G. A. Semenov and V. N. Moskalenko, Oceanology Institute imeni P. P. Shirshov, USSR Academy of Sciences, Moscow; Moscow Petrochemical and Gas Industry Institute imeni I. M. Gubkin]

[Abstract] Continuous seismic prifiling (CSP) work was done on the 28th cruise of the "Dmitriy Mendeleyev" for studying the structure of the sedimentary stratum in the Pacific Ocean. This CSP work was done in the area of occurrence of ferromanganese nodules (FMN). Radio buoys were used in determining the velocity of seismic waves. A high resolution and a reliable correlation of seismic waves was achieved on shipboard using a YeS-1010 computer, to which a "Gyuys-4" digital recording system was attached. Together with special programs, this made possible digital recording and preliminary processing of radio buoy and CSP data on the ship. An electrospark source was used as a source of elastic oscillations. The CSP records were used in constructing diagrams of thicknesses of the sedimentary stratum and

relief of the acoustic basement. CSP and radio buoy data registered on magnetic tape were used in computing the spectral characteristics and velocities of seismic waves. The complex was highly reliable and the records are convenient for use by interpreters and provides high-quality discrimination of reflecting boundaries. [A block diagram of the complex is given which is used in describing its functions and interrelationships.] Figures 5; references: 2 Russian.

UDC 551.463.2

SEA HYDROMETEOROLOGICAL MEASUREMENT COMPLEXES

Moscow OKEANOLOGIYA in Russian Vol 26, No 1, Jan-Feb 86 (manuscript received 19 Oct 83) pp 136-143

[Article by I. M. Shenderovich, Instrument Making Scientific Research Institute, USSR State Committee for Hydrometeorology and Environmental Control, Moscow]

[Abstract] During recent years two variants of a hydrometeorological measurement complex (HMMC) have been developed by the Instrument Making Scientific Research Institute for automatic marine hydrometeorological stations (AMHS). The first variant of the HMMC is for use with light drifting buoys; the second is for installation on large anchored buoys. These HMMC on the buoys transform the values of parameters into a repetition frequency or the number of electric pulses, process them in digital form and transmit these data to the station memory units. The systems have high noise immunity and oceanographic data can be transmitted by cable from great depths. Data processing is simple and individual sensors and units are interchangeable. (A block diagram, description of sensors and their technical specifications are given; these include: wind velocity sensor, compass sensor, air pressure sensor, air temperature sensor, water temperature sensor, sea water conductivity sensor and others. Such information is given for both variants.) All this apparatus has been tested in the laboratory and at sea. During the sea tests the buoy readings were compared with data from instruments aboard ships which approached to within 200 m of the buoys. It was found that the two sets of readings were in good agreement. This apparatus has passed official tests and has been recommended for standard production. Figures 4; references: 12 Russian.

UDC 551.465.6

## INFLUENCE OF SURFACTANTS ON DAMPING OF GRAVITY-CAPILLARY WAVES: I. FREQUENCY DEPENDENCE

Moscow OKEANOLOGIYA in Russian Vol 26, No 1, Jan-Feb 86 (manuscript received 22 Mar 84, after revision 30 Jul 84) pp 46-50

[Article by A. A. Lazarev and K. V. Pokazeyev, Space Research Institute, USSR Academy of Sciences, Moscow; Moscow State University imeni M. V. Lomonosov]

[Abstract] A study was made of the influence of surfactants on the damping of regular gravity-capillary waves in the range 2.5-16.0 Hz. Since the dissipation of these waves is dependent on surfactant characteristics, the results can be used in determining the type of pollution. Research was done on the damping of these waves in pure water and in the presence of surfactants of five different types. These included three which are insoluble (oleic acid, palmitic acid, dodecyl alcohol) and two which are soluble (sodium dodecyl sulfate and potassium laurate). An effort was made to simulate pollutants actually observed in the sea. The experiment was in a flume 7 m in length, 49 cm in width and 20 cm in depth. Computations agreed well with experimental data and revealed the existence of a quasiresonant dependence of the relative damping coefficient on the frequency of gravity-capillary waves. The damping effect of insoluble surfactants is somewhat less than for soluble surfactants. Figures 4; references 16: 10 Russian, 6 Western.

UDC 551.466:632.59

## INTENSIVE SYNOPTIC EDDIES AND QUASIGEOSTROPHIC APPROXIMATION

Moscow OKEANOLOGIYA in Russian Vol 26, No 1, Jan-Feb 86 (manuscript received 6 Mar 84) pp 28-35

[Article by Z. I. Kizner, All-Union Marine Fishing and Oceanography Scientific Research Institute, Moscow]

[Abstract] G. R. Flierl described a baroclinic Rossby soliton with axial symmetry and obtained an approximate solution for the equation for a quasigeostrophic eddy on a $\beta$-plane [DYN. ATM. OKEAN., Vol 3, No 1, pp 15-38, 1979]. This general problem was reexamined in order to ascertain the conditions for applicability of the equation for a quasigeostrophic eddy for description of well-developed synoptic currents (like rings, whose velocity of movement is much less than the orbital velocities of fluid particles) in a continuously stratified ocean. It was found that if in the expansion of the sought-for variables into power series for the Kibel number the zero approximation has circular symmetry relative to an arbitrary vertical axis, the horizontal components of current velocity are described with an error on the order of $O(Ki^2)$. The results obtained by Flierl are distinctly different

from the results obtained in this analysis in that the Flierl soliton moved westward with a phase velocity exceeding the phase velocities of linear Rossby waves, whereas the elongated wave revealed in the new reexamination travels eastward and it can have any phase velocity. Figures 1; references 8: 6 Russian, 2 Western.

UDC 551.465.11

DYNAMICS OF ISOLATED INTRATHERMOCLINE EDDY

Moscow OKEANOLOGIYA in Russian Vol 26, No 1, Jan-Feb 86 (manuscript received 6 Mar 84, after revision 21 May 84) pp 21-27

[Article by G. I. Shapiro, Oceanology Institute imeni P. P. Shirshov, USSR Academy of Sciences, Moscow]

[Abstract] There is a definite analogy between the dynamics of eddy lenses and solitary Rossby waves, but there are also very significant differences which make it impossible to apply the theory of nonlinear Rossby waves to such lenses. Accordingly, an in-depth study was made of this problem. Specifically, an investigation was made of the dyanmics of a thin, density-homogeneous, vortical fluid lens floating on the free surface, on the bottom or at the interface in a two-layer stratified fluid. A $\beta$-plane approximation was used. An asymptotic method was used in deriving an equation describing the dyanmics of a stationarily moving lenticular eddy. A precise analytical solution was found and and the conditions under which a solution actually exists were determined. The limitations which the unperturbed (computed in the f-plane approximation) characteristics of the lens must satisfy were ascertained and specific examples of fluid circulation in a lens were described. (This is based on the assumption that the orbital velocities of the fluid particles are considerably greater than the velocity of lens drift inducted by the $\beta$-effect and the Kibel number is much less than unity). It was demonstrated that in contrast to the dynamics of solitary, almost axisymmetric waves, under the influence of the $\beta$-effect lenses always move toward the west; slow solitary Rossby waves move only to the east. Figures 2; references 12: 5 Russian, 7 Western.

UDC 551.463:532.14.072(261.5)

APPLICATION OF DYNAMIC-STOCHASTIC MODEL IN STUDYING HEAT TRANSFER IN HYDROPHYSICAL TEST RANGE

Moscow OKEANOLOGIYA in Russian Vol 26, No 1, Jan-Feb 86 (manuscript received 9 Feb 84, after revision 30 Jan 85) pp 15-20

[Article by I. Ye. Timchenko, S. I. Khlopushina, V. D. Yarin and V. O. Belozerskiy, Marine Hydrophysics Institute, Ukrainian Academy of Sciences, Sevastopol]

[Abstract] The use of dynamic-stochastic models (DSM) can be highly effective in research on variability of oceanic fields in test ranges. A DSM of the density field was used in analyzing state of the ocean in the Amazon test range. Use was made of the equation of motion in the Boussinesq approximation and in the $\beta$-plane approximation the hydrostatic and incompressibility conditions and the density diffusion equation (on the assumption of a linear relationship between the temperature and salinity fields). The equations of ocean hydrodynamics were supplemented by the stochastic part of the DSM (equations for finding nominal mean density values and prognostic equation for standard deviation of prediction nonclosures). Observations in the test range were made in three surveys, two in February 1983 and one in March-April 1983. Soundings were made on three runs 60 miles apart with the station interval being 30 miles; 11 stations were occupied along each run to a depth of 2,000 m; observations were made at 10 horizons. Equations were integrated with a 12-hour time interval. A time series of maps was produced for density and current velocity (horizontal and vertical) fields for a graphic representation of evolution of these fields; such maps were prepared for all horizons. The satisfactory agreement between current velocities and directions confirmed the feasibility of using DSM for describing the variability of oceanic fields. The presented relatively simple DSM made it possible to trace the dynamics of heat and mass transfer processes. Figures 2; references 6: 5 Russian, 1 Western.

UDC 543.8

DEFINING 'CAVITATION' AND 'CAVITATION THRESHOLDS' CONCEPTS

Moscow ZHURNAL FIZICHESKOY KHIMII in Russian Vol 60, No 3, Mar 86 (manuscript received 16 Mar 84) pp 725-727

[Article by M. A. Margulis, All-Union Organic Synthesis Scientific Research Institute]

[Abstract] There is no clear and precise definition of the term "cavitation." A review of the literature was made in order to arrive at such a definition, taking into account the physical and chemical effects resulting from bubbles linearly pulsating in a fluid. The effect of division of cavitation bubbles

in the "collapse" process was examined and it was found that true collapse or disappearance of bubbles does not occur during compression. "Cavitation" can be defined as the process of pulsation, oscillation, growth, attraction or repulsion and other types of motion of bubbles regardless of the method for their generation and the effects produced by them. This takes in acoustic, hydrodynamic and "shock" cavitation, as well as laser-induced cavitation and cavitation generated by high-energy particles. "Cavitation threshold," earlier considered the time of appearance of cavitation, should be changed to "threshold of well-developed cavitation." The threshold is characterized by a jumplike increase in the number of cavitation bubbles and intensification of many physico-chemical and chemical effects. (Most experiments have actually been carried out for conditions of well-developed cavitation.) References 23: 14 Russian, 9 Western.

UDC 534.29:532.528

## RESEARCH ON SONOLUMINESCENCE MECHANISM. I. ONSET PHASE OF ULTRASONIC LUMINESCENCE OF FLUID

Moscow ZHURNAL FIZICHESKOY KHIMII in Russian Vol 60, No 3, Mar 86 (manuscript received 21 May 84) pp 646-650

[Article by A. K. Kurochkin, Ye. A. Smorodov, R. B. Valitov and M.A. Margulis, All-Union Scientific Research Technological Institute of Herbicides and Plant Growth Regulators, Ufa; All-Union Organic Synthesis Scientific Research Institute, Moscow]

[Abstract] Such characteristics of sonoluminescence as the phase of appearance of glow, distribution of probability of appearance of bursts relative to the period of an ultrasonic wave and the number of bursts during a period were examined in a study of the mechanism of sonochemical processes in relation to the sonoluminescence flux. The research made it possible to ascertain the phase of appearance of ultrasonic glow of a fluid and to clarify its correlation with the light-scattering curve for cavitation bubbles. Then the characteristics of bubbles whose "collapse" is accompanied by light bursts were determined. The apparatus used in the research (a block diagram accompanies the text) produces a signal with a frequency 22 kHz which is reduced to an oscillogram fed to the oscillograph screen. The sonoluminescent fluid used was glycerine because the bursts generated in cavitating fluids have the greatest intensity among the studied fluids. Fluid temperature was maintained at $60\pm2$°C. All experiments were made at atmospheric pressure. It was found that the maximum probability of bursts occurs in a phase in the region $-3\pi/8<\omega t<\pi/4$. The moment of emission of light pulses does not coincide with the minimum of the light scattering curve. The experiment revealed that data on the phase of sonoluminescence light bursts, their instability and statistical distribution with time can be explained within the framework of the new electrical theory of cavitation phenomena proposed by the author in ZHURN. FIZ. KHIMII, Vol 59, No 6, p 1497, 1985. Figures 4; references 14: 7 Russian, 7 Western.

UDC 551.465.153

## INFLUENCE OF SECONDARY EDDY CURRENTS ON SCATTERING OF ADMIXTURE IN ZONAL FLOW

Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA in Russian Vol 22, No 1, Jan 86 (manuscript received 24 Jul 84) pp 78-86

[Article by V. N. Yeremeyev, L. M. Ivanov, I. A. Neyelov and V. I. Smelyanskiy, Marine Hydrophysical Institute, Ukrainian Academy of Sciences]

[Abstract] Data on the drift of Sofar floats can be used for finding dynamic characteristics of the ocean in the range of synoptic-spatial scales, but there are serious difficulties in the interpretation of these data. The contribution of movements of different scales to the drift of such floats is difficult to discriminate and certain assumptions must be made concerning the statistical nature of float movements in order to ascertain the energy and other characteristics of hydrodynamic fields along the trajectories of the floats. An effort has been made to overcome these difficulties. The approach used [developed in other studies] was numerical analysis of movement and an admixture in nonstationary eddy fields. It was important to take into account that in the prediction of drifting floats an important role is played by baroclinically unstable currents of a jet character and the secondary eddy currents generated by them. The study was based on hydrodynamic fields computed using a numerical model describing an unstable zonal flow for analysis of dispersal of tracer particles. Numerical experiments were conducted for time intervals of about 5-6 months, comparable with the lifetime of an individual eddy. Computations were made in a grid with intervals 20 km with examination of 5 layers with depths 100-2,000 m and a time interval of 20 min. Two processes of eddy disappearance were found: decay of eddies into zonal currents and decay of large eddies into smaller ones. It was found that some characteristics of the eddy field can be determined from Sofar data. Conclusions can be drawn concerning the barotropization of the eddy field. Mean energy can be ascertained from the dispersion of floats. Zones of upwelling and subsidence of water masses in eddies can be determined. Figures 5; references 19: 13 Russian, 6 Western.

UDC 539.194.01

## INFLUENCE OF RELATIVE POSITIONING OF OPTICALLY ALLOWED AND FORBIDDEN $\pi\pi^*$ - TRANSITIONS ON SPECTRAL-LUMINESCENT PROPERTIES OF ORGANIC COMPOUNDS

Leningrad OPTIKA I SPEKTROSKOPIYA in Russian Vol 60, No 1, Jan 86 (manuscript received 4 May 84) pp 35-38

[Article by G. V. Mayer]

[Abstract] The spectral-luminescent systematization of the properties of hetero-aromatic molecules proposed by R. N. Nurmukhametov, et al. (ZhFKh, Vol 40, 1966), in which there are 5 types of relative arrangement of singlet and

triplet $\pi\pi^*$ and $n\pi^*$ states, was applied in this study. Particular attention was given to the lower $\pi\pi^*$ states which can be formed by both optically allowed and optically forbidden electron transitions. The first type of states is designated $S^{(+)}$ (corresponding to triplet states with the same electron configuration as $T^{(+)}$) and the second type of states is denoted $S^{(-)}$ (and $T^{(-)}$). The relative positioning of the lower singlet and triplet states (+) and (-) is the main factor determining the spectral-luminescent properties of aromatic hydrocarbons. The different dependence of the energies of singlet and triplet states on structure also gives 5 types of relative arrangement of $S^{(+)}$, $T^{(+)}$, $S^{(-)}$ and $T^{(-)}$ states. Examples of each of these 5 states are given. It is shown that with a change in the ambient medium the molecules can undergo transition from one type to another. Molecules with a nonrigid structure are characterized by presence of closely positioned allowed and forbidden electron transitions whose relative arrangement determines their spectral-luminescent properties. Using the defined types of relative arrangement of $\pi\pi^*$ transitions of different orbital nature it was possible to classify the spectral-luminescent properties of organic compounds. Figures 1; references 17: 8 Russian, 9 Western.

UDC 555.37+535.5

## POLARIZATION OF TWO-PHOTON EXCITED FLUORESCENCE OF COMPLEX ORGANIC MOLECULES IN VAPORS

Leningrad OPTIKA I SPEKTROSKOPIYA in Russian Vol 60, No 1, Jan 86 (manuscript received 5 Jun 85) pp 60-64

[Article by A. P. Blokhin, V. A. Povedaylo and V. A. Tolkachev]

[Abstract] Cross-sections of two-photon absorption $\delta$ were measured at the radiation frequency of the fundamental harmonic of a ruby laser, as was the polarization of fluorescence in the case of two-photon excitation (TPE) of rarefied vapors of such complex compounds as anthracene, perylene and POPOP. Vapors were excited by plane or circularly polarized multimode radiation with laser power density up to 35 MW/cm$^2$ (pulse duration $\sim$30 ns). Collisionless existence of the excited state was ensured. With TPE fluorescence was in the direction perpendicular to the exciting light beam. The cross-sections of two-photon absorption were determined by comparison of the fluorescence intensities arising under the influence of laser radiation and its second harmonic. With a power density greater than 10 MW/cm$^2$ (POPOP) and 20 MW/cm$^2$ (anthracene, perylene) there was a lessening of the increase in fluorescence intensity. A table gives the results of determinations of $\delta$, the degree of polarization of luminescence P, the $\Lambda$ factor (ratio of intensity of luminescence excited by circularly polarized light to the luminescence excited by plane polarized light) and corresponding temperature T, vapor pressure P and power density $W_1$. The behavior of each compound was studied. It was found that the principal contribution to absorption is from transitions with a parallel orientation of moments (in the case of perylene transitions along the short axis of the molecule predominated). An anisotropy of fluorescence of POPOP vapors was detected which was induced by light quenching. Figures 1; references 17: 6 Russian, 11 Western.

UDC 535.37+535.34

# ALLOWANCE FOR INFLUENCE OF TRIPLET-TRIPLET ABSORPTION WHEN USING OPTICO-ACOUSTIC EFFECT IN MEASUREMENTS OF QUANTUM YIELD OF LUMINESCENCE FROM HIGHLY EXCITED MOLECULAR STATES

Leningrad OPTIKA I SPEKTROSKOPIYA in Russian Vol 60, No 1, Jan 86 (manuscript received 16 Jul 85) pp 70-73

[Article by A. A. Krasheninnikov and A. V. Shablya]

[Abstract] A method is proposed for taking into account the influence of absorption from the triplet state on the quantum yield of luminescence from highly excited electron states of complex organic molecules. The investigation involved two-stage excitation induced by an optical-acoustic effect. The method requires determination of the difference in lifetimes of the triplet and singlet states of organic molecules. The contribution of triplet states to the acoustic signal was ascertained for 9,10-di-n-propyl anthracene, benzanthracene, acridine and acridone in solutions at room temperature. It was found that the contribution of triplet-triplet absorption to the acoustic signal $n_A$ (characterizing the relative efficiency of absorption $\nu_2$ by molecules) is dependent on the spectroscopic characteristics of the particular compound. Among the investigated compounds the greatest influence of the triplet state on the quantum yield of luminescence from highly excited states was for 1,2-benzanthracene. A table gives the $\gamma_n$ values ($\gamma_n$ is the quantum yield of luminescence from a highly excited electron state) computed with allowance for contribution of the triplet state to $n_A$. It is demonstrated that the absorption of exciting light by the triplet state must be taken into account when measuring $\gamma_n$ using exciting pulses of nanosecond duration. Figures 2; references 3: 2 Russian, 1 Western.

ESTONIAN ACADEMY HEAD K. K. REBANE SALUTED ON 60TH BIRTHDAY

Tallinn: SOVETSKAYA ESTONIYA, 11 Apr 86 p 3

[Article by N. Kristoffel, head of a sector of the Estonian Academy of Sciences' Institute of Physics]

[Abstract] On the occasion of the 60th birthday of Doctor of Physical-Mathematical Sciences, Professor Karl Karlovich Rebane, the article traces Rebane's career and salutes his achievements as a physicist and science organizer. Rebane is a corresponding member of the USSR Academy of Sciences and president of the Estonian Academy of Sciences.

It is recalled that Rebane defended a candidate dissertation in Leningrad State University's chair of theoretical physics and a doctoral dissertation at the Estonian Academy's Institute of Physics and Astronomy. A group of scientists under his direction was awarded the Estonian SSR State Prize for work on theory of optical properties of crystals with impurity atoms. Rebane subsequently became an organizer and the director of the Estonian Academy's Institute of Physics. He was elected president of the Estonian Academy in 1973.

Work on spectroscopy of crystals, molecules and biological systems such as chlorophyll reportedly was launched at the Physics Institute under Rebane's direction. Studies have been made of controlled change in the spectra of crystals through the action of laser radiation, which is said to hold promise in connection with the recording of enormous amounts of information. Rebane and his colleagues developed a general theory of luminescence of crystals during optical excitation, which led to the discovery of so-called hot luminescence.

Rebane is identified also as a leading organizer of research programs and the founder of a scientific school with an international reputation; a number of international scientific conferences devoted to aspects of this school's work have been held in Tallin, for example. Rebane has headed the USSR Academy of Sciences' scientific council on the problem "Optics" for a number of years. He is also the head of a republic laser program aimed at solving problems of industrial technology, and head of a chair of solid-state physics at Tartu University. Leading specialists of the Institute of Physics are among its instructors. It is noted that Rebane's children have also become physicists.

A photograph of K. K. Rebane is given.

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STUDIES OF THIN SURFACE FILMS AIM AT SEEING DEEP OCEAN PROCESSES

Moscow SOTSIALISTICHESKAYA INDUSTRIYA, 3 Apr 86 p 4

[Article by A. Zabotin]

[Abstract] "Sometimes watching a 'tempest in a teacup' is useful for understanding how a real storm occurs," remarked Doctor of Physical-Mathematical Sciences Ye. Pelinovskiy, associate of the USSR Academy of Sciences' Institute of Applied Physics, with a smile. "Look at this..."

A powerful fan was turned on, and the calm surface of water in a basin became rippled with waves. But one had only to drop a very small amount of oil on the water, from the tip of a needle, and the roughness subsided in a moment.

"It can be said in general of a film of an active substance that it is a world in itself, without thickness but possessing both elasticity and viscosity, like ordinary 'three-dimensional' substances," remarked Ye. Pelinovskiy. "This film can break up or flow, like a liquid, or it can crack, like a solid. Very interesting problems of physics, chemistry and technology are connected with films, and we are working on one aspect of one problem--studying effects which films produce on waves."

What happens on the surface [of water] is not the only thing that can be learned from a thin film. We might recall the dramatic incident involving the disappearance of the U.S. nuclear submarine 'Thresher'. The search for it went on for a long time, and what had happened to it could only be guessed at until oceanologists tackled the problem. They explained that an underwater storm had developed in the depths of the ocean at the time of the mishap. The vessel slid down the slope of an underwater wave to a depth where the submarine was crushed by the tremendous pressure of the water. Internal waves cannot be seen. By observing and photographing films on the surface, however, one can get an idea of what is happening deep in the ocean. And do still other things.

It may become possible to pour films in harbors which will protect them against rough seas, using specially selected substances which are harmless to animals and plants. An oil spill may be surrounded with a film which limits it and compresses it into a slick of small area, which is then easy to remove from the surface. Studies have begun which are aimed at preventing tropical hurricanes. These storms in fact originate as areas of intensified evaporation, which could be prevented by covering the surfaces of such areas with a film.

Practical applications of artificial films such as their use to prevent storms are still a long way off, to be sure. How films influence large waves is still a mystery to scientists. But physicists have already learned much from smaller waves that are a few decimeters in length.

An unexpected effect was recorded for the first time during a cruise of the scientific research ship 'Vityaz' in 1983: a film smoothed out small ripples, but on the other hand, it intensified waves up to a meter in length. This effect could serve as an identifying mark of places that are covered by films. It is very important to have a reliable method of finding such places in the ocean. Especially if aerial photograph or photography from space can be used for this purpose.

Observations and experiments have now been in progress in the Black Sea for several years in succession. Films of organic substances have been applied artificially to the surface of the sea. Ten liters is enough to create a slick with an area of 900 by 300 meters, for example. Such a thin film is quite invisible on the water, but the picture of roughness is radically altered.

These thin films, which are sometimes only as thick as a molecule, have been found to hold quite a few secrets which are entrusted to it by the ocean's depths and fresh breezes. Scientists are only now beginning to unlock these secrets.

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MARINE GEOLOGY EXPEDITION TO WORK OFF COAST OF GUINEA

PRAVDA UKRAINY, 24 Apr 86 p 4

[Article by Ye. Guzhva]

[Abstract] The scientific research ship 'Professor Kolesnikov' has departed on another cruise. A new marine geology expedition has begun in the Atlantic Ocean.

The leading role in the coordination, organization and conduct of marine expeditionary operations of Ukrainian specialists for the study of the geology of the world's oceans belongs to the Ukrainian Academy of Sciences' Commission on the Problem "Geology of the Seas and Oceans", and also to one of the oldest institutions of the Ukrainian Academy of Sciences--the Institute of Geological Sciences, where marine geology was initiated as a new pursuit in 1962.

In 1984, studies of the second specialized geological-geophysical expedition were conducted in the tropical zone of the Atlantic under the scientific direction of Ye. F. Shnyukov, member of the Ukrainian Academy of Sciences. The results of these studies, in addition to other important scientific findings, included the discovery of sedimentary formations enriched with phosphorite-glauconite and ore minerals on the coastal shelf of the Republic of Guinea by specialists of the Ukrainian Academy's Institute of Geological Sciences and Institute of the Geochemistry and Physics of Minerals. These results represented an important contribution to Soviet-Guinean scientific cooperation. This cooperation has been facilitated in large measures by the functioning of the Soviet-Guinean Scientific Research Center in Conakry, which is the only scientific institution of its kind in all of West Africa.

The new specialized geological-geophysical expedition of the Ukrainian Academy began working in April.

"Studies will be conducted by specialists of institutes of the Ukrainian Academy's Department of Earth Sciences, with the participation of scientists from the scientific research center in Conakry," related Candidate of Geological-Mineralogical Sciences A. Yu. Mitropolskiy, leader of the expedition and head of a laboratory of the Ukrainian Academy's Institute of Geological Sciences. "The program of research on the coastal shelf zone of the Republic of Guinea is to include study of geophysical, geological and geomorphological characteristics of the coastal shelf and of the continental slope, study of

hydrochemical and hydrological conditions, and also study of conditions that led to the formation of sedimentary rock and to phosphorite formation and ore mineralization of bottom sediments."

The "Professor Kolesnikov" is not a large ship; its draft permits it to conduct geological and geophysical surveys in close [to shore]. The expedition will pool the efforts of personnel of the Institute of Geological Sciences, the Institute of Geophysics imeni Subbotin, the Marine Hydrophysical Institute, and the Institute of the Geochemistry and Physics of Minerals.

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SPECIALISTS VIEW STATUS OF OCEAN HYDROPHYSICS RESEARCH

Moscow VODNYY TRANSPORT, 19 Apr 86 p 4

[Abstract] In the last decade, hydrophysics became a field of keen interest, one which is expected to yield the economy considerable profits and savings of resources. Academician S. A. Khristianovich, a State Prize laureate, and Doctor of Physical-Mathematical Sciences Yu. D. Chashechkin, one of the leading hydrophysics specialists of the USSR Academy of Sciences' Institute of Mechanics Problems, answered questions of our correspondent about research and undertakings which are now in progress.

"Sergey Alekseyevich, it has been said that the world's oceans are a closed book, and that a considerable number of years still must pass before man will be able to study their properties and to obtain truly incalculable treasures from their depths. Is this so?"

"Yes, indeed. In recent years, aspects of the seas and oceans that have been little studied as yet have held more and more attraction for scientists all over the world.

"It is clear that the organization of experiments in the ocean is an extremely complex task. Local measurements often do not yield the necessary findings, although such measurements have made it possible to gather a vast amount of statistical material. Only comparatively recently has it become possible to supplement these measurements with organization of global experiments. This pertains primarily to space oceanography and acoustic sounding of the oceans, including acoustic tomography.

"But the present-day situation in hydrophysics is characterized by still other advances. At least two more factors are highly important. The first is the progress of physical modeling; more and more laboratory units and tanks are being developed which permit the study, on a small scale, of processes which, from the technical standpoint, are very difficult to study in natural conditions. The second is computer experiments, which are making it possible to approach the solution of problems of the ocean's behavior over large expanses.

"Hydrophysical problems are now attracting researchers in the most diverse specialties: oceanologists, acoustics and optics specialists, radiophysicists, engineers and mathematicians."

"Yuliy Dmitriyevich, I would like to ask you to tell about prob ems which have been discussed in recent years at national hydrophysicists' workshop-seminars, of which you have been an organizer."

"One of the most important problems is study of surface and internal waves as an effective means of diagnosing the ocean. Also of great value is work on the evolution of ordered eddy currents or eddy structures in the ocean. The importance of developing a precise theory of long rolling waves and their interaction with underwater currents and the unevenness of the ocean floor also must be noted.

"All of these questions are extremely important for solving problems of monitoring environmental pollution and of the stability of various marine engineering structures, and for forecasting destructive action of sea currents and waves and protecting against them. These results will find use also in acoustic communications in the ocean, and in the description of weather and climatic phenomena."

S. A. Khristianovich said in conclusion: "Measurements are made of all waves, processes, dynamic and water systems, and of changes taking place in the atmosphere and in the ocean depths. This is done everywhere in the world, and many measurements and experiments have already been carried out. After all, extraction of minerals from the floors of seas and oceans is to begin in the very near future. For this purpose, the situation evolving at deep levels must be known, from both the physical and the mathematical standpoint, and everything must be known about currents and waves. In short, the ocean's processes must be described precisely."

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## NEW SEISMOGEOPHYSICAL OBSERVATORY INSTALLS MUON TELESCOPES

Frunze SOVETSKAYA KIRGIZIYA, 20 Apr 86, No 100 (17275), p 3

[Text] The seismogeophysical observatory "Ala-Archa" of the Kirgiz Academy of Sciences' Institute of Seismology has become fully operational. It is located in a canyon of the Kirgiz Ala-Too region. Along with an automatic tiltmeter station, which is one of the first in the country, a quartz rod deformeter has been put into service. With the aid of two quartz tubes, signals from deformations of the earth's crust are transmitted to the observatory's building and are recorded with an accuracy of within a micron.

The seismogeophysical observatory also has installed muon telescopes which record cosmic rays that penetrate the earth. Scientists are assuming that changes in the intensity of rays passing through the mass of rock will provide a possibility for predicting earthquakes.

Doctor of Geological-Mineralogical Sciences F. N. Yudakhin, deputy director of the institute, told our correspondent that the republic's seismologists now possess an extensive set of methods for studying precursor phenomena associated with strong earthquakes.

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## LABORATORY SIMULATION OF SEISMIC EVENTS

Moscow Domestic Service in Russian 0650 GMT 16 Mar 86

[Text] Moscow, 15 March [TASS]. The NAUKA I ZHIZN (Science and Life) magazine has reported that a complex for checking the strength of structures at atomic electric power stations, capable of imitating an earthquake, has been created by Moscow specialists. It is capable of testing equipment of a mass up to 50 tons, moving it in three directions and turning it three-dimensionally.

The new testing ground consists of a 200-ton seismic platform on which the installations to be tested are placed - individual units of atomic power station equipment, or large-scale models or mock-ups of stations. Twelve electrohydraulic knockers make the platform move in the required fashion.

The testing ground can also reproduce oscillations which are registered by a seismograph during a real earthquake. Up to 224 sensors can be installed at different points of the testing apparatus in order to collect information simultaneously about the movements and accelerations of its parts, about the mechanical stresses in them, and other parameters.

The entire research, from starting the movement of the seismoplatform to the output of the results of the experiment, is totally automated, and controlled with the help of two universal minicomputers which are included in the complex. Programs have also been worked out for experiments which recreate earth tremors of varying force.

The seismic experimental complex will enhance the effectiveness of the work of engineers and designers.

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SEISMOACOUSTICS ENHANCES MINERS' SAFETY

Moscow TASS in English 18 Mar 86

[Text] Detectors developed by engineers in Donetsk (the Soviet Ukraine) can discern the "voice" of a coal seam in the polyphony of sounds and noises. The devices will be used at seismoacoustic stations, their purpose being to enhance the safety of miners.

About 70 mines of the Donetsk coal-producing region are equipped with microphones and radio transmitters relaying sounds to the seismoacoustic stations which intently listen to noises underground. Upon detecting the characteristic crunching sound of a coal seam experiencing immense pressures, the detectors sound off an alarm. All work in a potentially dangerous area is rapidly cancelled.

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EARTHQUAKE PROTECTION, WARNING SYSTEMS FOR NUCLEAR POWER PLANTS

Moscow KOMMUNIST, 23 Mar 86, No 73 (15752), p 2

[Article by V. Musayelyan]

[Text] Personnel of the Yerevan affiliate of the All-Union Scientific Research Institute for the Operation of Nuclear Power Stations (VNIIAES) are solving the problem of developing a reliable system for shutting down reactors of nuclear power stations in the event of major earth tremors. The scientists have already developed an industrial earthquake protection system which ensures monitoring of the level of tremors from earthquakes on the territory of a nuclear power plant. When major tremors occur, this system will issue suitable commands, which will be received by an automatic safeguard device. The signal to stop the reactor will be issued practically instantly, whereas it would take an operator a certain amount of time to perform the operations involved.

Production of these devices has been organized at the Yerevan affiliate of VNIIAES. All of our country's nuclear power stations will be equipped with them, as will foreign stations built to Soviet plans.

Work on the development of a radio system for warning of earthquakes in advance is now in progress at the affiliate. Instruments of this system installed at a certain distance from a nuclear power station will record seismic waves coming from the epicenter of an earthquake and then warn of the impending danger, by means of a radio signal. The warning will be issued up to 5-6 seconds in advance, since a radio signal is propagated much faster than a seismic wave.

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GEOMAGNETIC FIELD STUDIES MAY AID PROSPECTING, COMMUNICATIONS

Minsk SOVETSKAYA BELORUSSIYA, 19 Apr 86, No 91 (16674), p 2

[Text] Periodic changes in solar activity have begun to be taken into account by geologists of Belorussia in prospecting ore deposits. The variability of the sun's radiation causes fluctuations in the geomagnetic field. Scientists of the Belorussian Academy of Sciences' Institute of Geochemistry and Geophysics have summarized data of experiments that have been conducted for a quarter of a century at the Pleshchenitsy Geophysical Observatory, and they have compiled a forecast of variations in the structure and dynamics of the earth's electromagnetic mantle in the middle latitudes.

References to this forecast which the geologists now are practicing are heightening the accuracy of assessment of deposits and are making the search for them less costly. Regularities of the behavior of the planet's magnetosphere which have been revealed have significance also in the study of deep-seated layers of the earth's crust, and also for communications, medicine and cosmonautics.

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CONTINUING WORK ON EMP PROBING OF EARTH WITH MHD GENERATORS

LENINSKOYE ZNAMYA, 16 Mar 86, No 66 (20086), p 4

[Abstract] Electromagnetic probing of the earth using a pulsed source of current--a magnetohydrodynamic generator--has been noted among the most important scientific achievements of recent years. This work was done in the area of the Kola Peninsula by a group of scientists under the direction of Ye. P. Velikhov, vice-president of the USSR Academy of Sciences. The experiment that was performed consisted essentially in 'x-raying' a vast territory of the Kola Peninsula to a depth of tens of kilometers. Doctor of Physical-Mathematical Sciences, Professor M. S. Zhdanov, head of a department of the USSR Academy of Sciences' Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation (Troitsk), related the following about the latest studies.

"The interest of specialists in methods of deep-level electromagnetic probing with controlled (artificial) sources has intensified in recent years. The strength and configuration of the current in these sources are prescribed by a researcher. But here the problem arises of developing powerful sources of current which create artificial fields of the kind that penetrate the earth to great depths.

"This problem was solved successfully by a group of scientists of the Atomic Energy Institute imeni Kurchatov and the High Temperatures Institute of the USSR Academy of Sciences, who proposed the use in geophysics of high-capacity pulsed magnetohydrodynamic generators which develop colossal power--up to 40,000-60,000 kilowatts--in short pulses and generate current as strong as 20,000 amperes.

"Several types of geophysical MHD units have now been developed in the USSR. One of them, the MHD unit 'Khibiny', is located on the Kola Peninsula and is used for inspecting the depths of the Kola Peninsula and the adjoining coastal shelf of the Barents Sea, to depths of tens of kilometers. One feature of the Kola experiment is that the MHD generator here is set up on the narrow isthmus which connects the Kola Peninsula with the Rybachiy Peninsula. Current generated by the MHD generator flows through two massive aluminum conductors to metal grounds; they are placed in the two bays which surround the isthmus. The current then spreads out into the sea, forming diverging loops with radii of 40-100 kilometers around the Rybachiy Peninsula. These loops of current are the primary sources of the electromagnetic field which probes the earth.

"The experiment for electromagnetic inspection of the earth is now continuing. For the purpose of heightening the keenness' of underground vision in the MHD generator's 'beams,' geophysicists have to solve many complex problems: development of new digital measuring apparatus, and of new methods for interpreting results and constructing an 'underground' picture' of the earth."

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FIELD STUDIES OF EARTHQUAKES' BIOLOGICAL PRECURSOR PHENOMENA

Alma Ata KAZAKHSTANSKAYA PRAVDA, 30 Mar 86, No 79 (19205), p 4

[Article by V. Fremd, student, Kazakh State University]

[Abstract] Bioseismology is one of the new directions of the study of tremors of the earth's crust.

For a long time, people have noted restless behavior of animals preceding strong earthquakes. Data on animals as warning indicators of this phenomenon have been fragmentary, however. Intensive work on developing a hypothesis of biological precursor phenomena has begun in many countries of the world. Such studies have also begun in Kazakhstan. At the initiative of Doctor of Biological Sciences, Professor P. I. Marikovskiy, a biological test area has been established under the Kazakh Academy of Sciences' Institute of Seismology.

This unique laboratory is located high in the mountains, not far from the Ushkonur Plateau. A few small railroad cars in which people live, and a small open-air cage for animals are all of the facilities of this complex, whose work is original in concept and involves serious tasks.

"There is an opinion that an ability to sense impending earthquakes would have had to develop to a high degree in burrowing animals in the course of evolution, since those which survived would be the ones who left their burrows in time," said V. Pole, head of the biological test area. "We shall therefore conduct our studies chiefly with porcupines, badgers and marmots. They are animals which live in burrows but are nevertheless easy to observe. In the first place, we must obtain a background recording of the animals' ordinary behavior, on the basis of which anomalous reactions of the subjects will be discerned.

"For now, porcupines are the animals that have been brought to our test area. We have tried to create conditions for them which are as close as possible to natural ones," continued Viktor Borisovich. "But we intend later on to install seismic sensors near the burrows of badgers and marmots living in the wild. We will take care not to affect the animals' behavior; the sensors will be buried in the ground and installed in the winter, when the animals are mostly hibernating. Background recording will be done around the clock,

for at least a year. Sensors will record the animals' movements out of their burrows and back, as well as their movements in the burrows."

Seismologists are now successfully solving the problem of long-term forecasting of earthquakes. The task of the biological test area is short-term forecasting, for periods of several days or even hours.

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UDC 550.34.01

## TIDAL ANOMALIES AND HEAT FLOW IN WESTERN AND CENTRAL EUROPE

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 286, No 6, Feb 86 (manuscript received 2 Apr 85) pp 1351-1354

[Article by P. Melkhior, Belgium, and A. M. Sadovskiy, Earth Physics Institute imeni O. Yu. Shmidt, USSR Academy of Sciences, Moscow]

[Abstract] A correlation has been established between anomalies in the M2 tidal wave and the heat flow in western and central Europe. Areas with greater heat flow correspond to positive tidal anomalies and vice versa. Both phenomena reflect the mobility of the lithosphere, and may therefore be correlated. A study of the possible correlation indicates that tidal anomalies are positive and negative in areas with high and low heat flow. Areas with intermediate Q, 60-70 $mW \cdot m^{-2}$, contain approximately the same number of points with positive and negative anomalies. Both of these characteristics can be correlated with other integral characteristics reflecting the mobility of the lithosphere, such as relief. Therefore, they do not indicate a direct relationship between heat flow and tidal anomalies. Figures 3; references 3: 1 Russian, 2 Western.

UDC 550.38

## CONDITIONS FOR MAGNETIC FIELD GENERATION

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 286, No 1, Jan 86 (manuscript received 27 Dec 83) pp 74-77

[Article by V.A. Dubrovskiy, Earth Physics Institute imeni O. Yu. Schmidt, USSR Academy of Sciences, Moscow]

[Abstract] Based on the laws of conservation, certain general criteria are obtained which allow prediction of the mutual configurations of flows of a conducting fluid and a magnetic field in the case when a magnetic dynamo can operate. The research was based on an ordinary system of equations of magnetohydrodynamics for an incompressible, viscous, conducting fluid. It is found that for fields with little vortexting of rot H, a situation is

possible such that the generated field energy density is significantly greater than the density of kinetic energy of the flow of conducting fluid responsible for the generation. This conclusion is important because this is the situation proposed for the case of the earth. The dipole field can increase due to small additions to a significant value. References: 3 Russian.

UDC 553.983

NATURAL FUEL GASES AND PETROLEUM IN AMUR REGION

Novosibirsk TIKHOOKEANSKAYA GEOLOGIYA in Russian No 6, Sep-Oct 85 (manuscript received 19 Apr 85) pp 71-85

[Article by O.V. Ravdonikas and G.I. Ivanov, Tectonics and Geophysics Institute, Far Eastern Scientific Center, USSR Academy of Sciences, Khabarovsk]

[Abstract] Materials collected by the authors and associates at various institutes are used in predictions of the likelihood of finding hydrocarbons in the Bureinsk depression. The prospecting work, including significant amounts of deep drilling in a most promising area of the depression, has yielded no positive results to date. However, systematization of information on the appearance of oil and gas at the surface has provided information, together with geological information, upon which to base a prediction of the discovery of hydrocarbon deposits in the depression. Gas hydrate deposits are possible at depths of 70 to 200 m, with gas, gas condensate and petroleum deposits probable at greater depths. The strategy of future search for hydrocarbons in these areas should be based on the results of regional geophysical studies and prospecting drilling. Figures 5; references: 11 Russian.

UDC 553.061

ROLE OF DIAGENESIS IN FORMATION OF FERROMANGANESE NODULES IN CLARION-CLIPPERTON ORE PROVINCE

Novosibirsk TIKHOOKEANSKAYA GEOLOGIYA in Russian No 6, Sep-Oct 85 (manuscript received 11 Feb 85) pp 60-70

[Article by Ye. S. Bazilevskaya, Geology Institute, USSR Academy of Sciences; Commission on Ocean Problems, USSR Academy of Sciences, Moscow]

[Abstract] A method was developed for direct determination of Mn(II) in ocean sediments and ferromanganese nodules, based on the easy solubility of Mn(II) in dilute sulfuric acid and the almost total insolubility of Mn(IV) in this same solvent. The method is used to study the distribution of bivalent manganese in the sedimentary floor of a large area of the Pacific. The results indicate that diagenetic delivery of metals from the sedimentary

mass is decisive in the formation of the nodules. Studies were made during the 28th cruise of the research vessel "Dmitriy Mendeleyev" in an area southeast of Hawaii. The nodules are formed by diagenesis within the nodules themselves with sea water and its suspensions forming the main source of metals arriving at the ocean floor. The nodules are formed in the metal-saturated silty water in the upper sedimentary levels, with the high concentration of metal in the oozy waters supported by equilibrium with metals in the solid phase of the ocean floor. The concentration mechanism of the metals is related to the properties of the finely dispersed clay sediment and is independent of the presence or absence of nodules on the surface of the sediment. Figures 2; references 38: 12 Russian, 26 Western.

UDC 550.831(265.3)

## GRAVITY FIELD OF SEA OF OKHOTSK REGION AND ITS INTERPRETATION IN COMBINATION WITH BATHYMETRIC AND SEISMIC DATA

Novosibirsk TIKHOOKEANSKAYA GEOLOGIYA in Russian No 6, Sep-Oct 85 (manuscript received 1 Jul 83) pp 49-59

[Article by V. A. Baboshina, A.A. Tereshchenkov and V.V. Kharakhinov, Sakhalin Scientific Research and Production Institute for Petroleum and Gas, Okha-na-Sakhaline]

[Abstract] Data from gravimetric, bathymetric and seismic studies are interpreted jointly. The gravity field studies were undertaken as a part of combined studies of the Sea of Okhotsk region intended for tectonic regionalization and determination of the thickness of oil- and gas-bearing sedimentary deposits. Maps are presented showing the morphological structure, gravitational elements and thickness of the sedimentary cover in the region. The analysis indicates that the Sea of Okhotsk region has a mosaic block structure related to the dynamics of formation of ocean floor relief. The major determining process in Cenozoic tectonics of the region was destruction of the crust. The location and structure of sedimentary basins, controlled by large systems of depressions, depend on the size and scale of rift-creating destruction. Rift depressions, with intensive down-warping during the Cenozoic, accompanied by increased thermal activity and favorable composition of sedimentary deposits, are most promising for oil and gas. These include the Sakhalin, northern Okhotsk and western Kamchatka rift zones. Figures 4; references: 13 Russian.

UDC 550.837

## DEEP GEOELECTRIC MODEL OF SOUTHERN KAMCHATKA

Novosibirsk TIKHOOKEANSKAYA GEOLOGIYA in Russian No 6, Sep-Oct 85 (manuscript received 5 Mar 84) pp 100-105

[Article by Yu.F. Moroz, Kamchatka Geophysical Expedition, Yelizovo]

[Abstract] Research conducted by Kamchatka's Yelizovo Geophysical Expedition on the structure of the crust and upper mantle by the magnetotelluric sounding method in southern Kamchatka indicates the existence of a conducting layer with a resistivity of 10-15 ohms per meter which rises from 100-150 km along the coast to 70 km in the volcanic belt. The resistivity of this layer decreases as it rises. The specifics of the deep geoelectric cross section are reflected in the magmatic and hydrothermal activity in the region. The low resistivity indicates partial melting of the ultrabasic upper mantle rock and is possibly related to the asthenospheric zone of partial melting, the top of which rises from 100-120 km in the west and east portions of the area studied to 70 km in the volcanic belt area. Figures 6; references 14: 13 Russian, 1 Western.

UDC 550.831

## SOLUTION OF THREE-DIMENSIONAL INVERSE PROBLEM OF GRAVIMETRY IN CONTACT SURFACES CLASS BY LOCAL CORRECTIONS METHOD

Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA FIZIKA ZEMLI in Russian No 1, Jan 86 (manuscript received 6 Jun 84) pp 67-77

[Article by I.L. Prutkin, Geophysics Institute, Urals Science Center, USSR Academy of Sciences]

[Abstract] The author recently proposed a local corrections method for approximate solution of nonlinear inverse problems. The method does not utilize nonlinear minimization, allowing computer time to be reduced by an order of magnitude. The method was previously successfully applied in solving nonlinear three-dimensional inverse problems of gravimetry and magnetometry in a class of limited objects. The local corrections method is now applied to solution of inverse problems in the contact surfaces class. It is emphasized that the three-dimensional inverse problem is solved in its full, nonlinear formulation, and that the method can be used to construct one or several contact surfaces. The amount of machine time required for solution of the problem is the same as for the solution of the inverse problem in its linearized formulation by a simple method, while the quality of solution obtained is much better. A regularization method for solution of the problem is suggested. References: 9 Russian.

UDC 550.343.6

# DYNAMICS OF DEVELOPMENT OF LONG-TERM SEISMOLOGIC PRECURSORS

Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA FIZIKA ZEMLI in Russian No 1, Jan 86 (manuscript received 21 Jun 82, after revision 15 Nov 84) pp 39-51

[Article by I.L. Nersesov and B.G. Rulev, Earth Physics Institute imeni O.Yu. Shmidt, USSR Academy of Sciences]

[Abstract] Long-term seismologic observations in Tajikistan undertaken by a combined seismologic expedition of the Earth Physics Institute provided a rare opportunity to study variations in seismic processes over long periods of time in a limited area in significant detail. Two major areas of study were undertaken: the space-time fluctuations in weak earthquakes of energy class 9-10, and weak earthquakes and microtremors studied in greater detail in a local area, including such parameters as the number of microshocks and their relationship to weak earthquakes, variations in seismic wave velocities and changes in focal mechanisms. The 19-year series of observations reveals long-term anomalies in the time variations of the seismic process which are analyzed from the standpoint of the dynamics of development of the long-term precursors of strong earthquakes. An algorithm for location of quiet zones is implemented on a computer for processing of seismic information. The resulting information is represented on maps for the seismic situation in 1982-1983, a period during which two significant earthquakes occurred. Figures 5, references: 8 Russian.

PHYSICS OF ATMOSPHERE

## LASERS MEASURE ATMOSPHERE

Moscow TASS in English 27 Apr 86

[Text] Minsk, 22 April. Laser detection and ranging instruments developed by Belorussian scientists--lidars--have done architects a good turn. Instruments capable of determining the composition of the atmosphere in small areas have helped in the drafting of a design for a resort on Lake Naroch in Soviet Belorussia. Physicists in that republic investigated the region around the lake and found optimum rayons, in terms of ecology, where there is especially pure air, impregnated with the scent of pine. It will contribute to the improvement of rest and treatment in new rest homes and sanatoria.

The Belorussian physicists lead the field in creating several types of optical quantum generators, which operate, for instance, on a mixture of helium and neon and also on solutions of organic dyes, including ordinary blue and green dyes. Such instruments are successfully used for sounding the sea, plasma study and acceleration of reactions. The selection specialists developed, with the help of lasers, high-yielding varieties of frost and lodging resistant cereal crops.

"A beam of light can be a creator, as well as a destroyer, and I consider that each achievement of a leading mind has to serve a humanitarian aim," said Boris Stepanov, director of the Belorussia Institute of Physics to the TASS correspondent.

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SPECIFICS OF PROPAGATION OF RADIO NUCLIDES DISCHARGED INTO LOWER LAYER OF ATMOSPHERE DURING REGENERATION OF FUEL ELEMENTS

Moscow ATOMNAYA ENERGIYA in Russian Vol 59, No 5, Nov 85 (manuscript received 3 Aug 84) pp 373-375

[Article by I.N. Ruzhentsova, R.V. Semova, Ye.N. Teverovskiy and I.A. Ternovskiy]

[Abstract] Regeneration of spent fuel elements is accompanied by emission of long-lived radioactive gases and aerosols into the atmosphere. Aerosol samples were taken from the gas-air mixture leaving a ventilation stack 150 m in height. The radionuclide composition of the aerosol was determined by a gamma spectrometric apparatus. At distances of over 800 m from the stack, atmospheric contamination was found to result primarily from radioactive particles with no significant rate of gravitational precipitation, scattered in the atmosphere by turbulent diffusion. At distances of over 1 km from the source the contribution of particles with diameters greater than 8-10 μm is about 20%. Atmospheric inversions can increase atmospheric contamination by factors of up to 10. References: 4 Russian.

UDC: 533.72:541.182

THERMOPHORESIS OF SPHERICAL AEROSOL PARTICLE AT ARBITRARY KNUDSEN NUMBERS

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 285, No 6, Dec 85 (manuscript received 13 Mar 85) pp 1377-1381

[Article by S.A. Beresnev, V. G. Chernyak, Ural State University imeni A.M. Gorkiy, Sverdlovsk]

[Abstract] For the first time a solution is presented to the problem of thermophoresis of a solid spherical particle in a monatomic gas for arbitrary values of Knudsen number Kn = l/R, where l is the mean free path length of a gas molecule and R is the radius of a particle. The problem was solved for the steady-state case by the use of linearized kinetic equations with operators for intermolecular collisions in the form of the BGK model and the S model. Figures 2; references 15: 4 Russian, 11 Western.

UDC 551.465.71

## THEORY OF HEAT AND MOISTURE EXCHANGE BETWEEN FINELY DISPERSE STORM-GENERATED SPRAY AND TURBULENT AIR FLOW

Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA in Russian Vol 21, No 11, Nov 85 (manuscript received 14 May 84, after revision 11 Nov 84) pp 1191-1197

[Article by Ye. P. Borisenkov and M. A. Kuznetsov, Main Geophysical Observatory]

[Abstract] The expressions describing heat and moisture exchange between finely disperse spray and a turbulent air flow were improved. The requirements on description of the motion of fine particles were reduced and it was found that in a definite part of the spectrum of spray particle sizes there is no need to compute particle flight time, thereby great simplifying determination of heat and moisture exchange during storms. Salinity plays a major role in this process. An increase in salinity results in a slowing of evaporation and its subsequent cessation. It is essential that salinity be taken into account for droplets with $D \leq 100\ \mu m$. The mean temperature of spray particles is extremely close to the air temperature in the near water layer; there is no dependence on water temperature. With the expressions derived it is possible to predict the sizes of aerosol particles entering the atmosphere when there are moderate or strong winds. The number of heavy spray particles in the total flux is small and can be neglected in calculating energy exchange. Further progress along these lines is impossible without much more experimental data on turbulence parameters in the near-surface water layer. Nevertheless, these important new findings and clarifications improve computations of total energy exchange between the ocean and atmosphere. Figures 1; references 9: 8 Russian, 1 Western.

UDC 551.510.42

## SPECIFIC FEATURES OF MULTIPLE COUNTING OF PARTICLES BY PHOTOELECTRIC COUNTERS

Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA in Russian Vol 21, No 11, Nov 85 (manuscript received 21 Mar 84, after revision 22 Jan 85) pp 1166-1172

[Article by Yu. V. Zhulanov, A.A. Lushnikov and I.A. Nevskiy, Physicochemical Scientific Research Institute imeni L. Ya. Karpov]

[Abstract] An effort was made to broaden the range of aerosol concentrations measured with photoelectric counters. The principal objective was to find a method for overcoming the error in determining concentration due to simultaneous entry of two or more particles into the sensing volume, which are registered as one. A method for solving this problem was published by the authors in J. AEROSOL. SCI., Vol 15, No 1, pp 69-79, 1984, which is based on an analysis of the probability of simultaneous entry of such multiple particles.

On this basis the problem is further clarified, with emphasis on determination of the total number of readings during flight of a given number of particles as a function of the counter triggering threshold. It was found that pulsed illumination ensures greater accuracy in measuring particle concentrations, with significant enhancement of instrument response. A precise expression was derived for the probability of registry of multiple entries being counted as one. The method is effective for plotting vertical profiles of atmospheric aerosols with a high spatial resolution. References 7: 4 Russian, 3 Western.

UDC 551.501

MULTIWAVE LASER SOUNDINGS OF ATMOSPHERIC AEROSOL: EXPERIMENTAL RESEARCH (REVIEW)

Minsk ZHURNAL PRIKLADNOY SPEKTROSKOPII in Russian Vol 44, No 2, Feb 86 (manuscript received 14 Jun 85) pp 183-197

[Article by A.P. Chaikovskiy]

[Abstract] This article is a review of the Soviet and Western literature on multiple-wavelength laser soundings of atmospheric aerosol. Primary attention is given to practical implementation of the method and analysis of the capabilities of its application for determination of the microstructure of aerosol in a number of specific situations. Problems of the theory of multiwave soundings are discussed only to the extent to which such discussion is necessary for an understanding of the method and analysis of the results of experimental research. The amount of information obtained by multiple wavelength laser soundings can be increased by expanding the spectral band of the lidars. This is quite possible at present, but the creation of such apparatus would be a complex technical problem requiring commitment of significant resources. It is therefore often more desirable to perform multiwave soundings in combination with other optical and microphysical measurements to achieve the same results. Figures 5; references 97: 68 Russian, 29 Western.

UDC [528.5+621.38]:522.92

USE OF ELECTRON BEAM INSTRUMENTS TO DETERMINE FLUCTUATIONS IN VERTICAL REFRACTION PARTIAL ANGLE

Moscow GEODEZIYA I KARTOGRAFIYA in Russian No 2, Feb 86, pp 21-23

[Article by A.S. Kolos]

[Abstract] An analysis was made of the possibility of determining fluctuations in the partial angle of vertical refraction based on fluctuations of an image on the screen of a cathode ray tube. Determination of the partial angle of vertical refraction and consideration of leveled refraction requires

highly accurate measurement of the maximum amplitude of image fluctuation over a certain period. Experimental observations were made over distances of 150 and 200 m over a homogeneous road surface. The use of fiber optic screens resulted in an increase in image resolution and contrast, allowing work to be done on a bright sunny day. References: 4 Russian.

UDC 551.521.32:551.576.1

## LIDAR-RADIOMETRIC METHOD FOR DETERMINING LIQUID-WATER CONTENT OF CIRRUS CLOUDS

Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA in Russian Vol 22, No 1, Jan 86 (manuscript received 26 Jul 84) pp 44-52

[Article by V.A. Zhuravleva and O.K. Kostko, Central Aerological Observatory]

[Abstract] A new lidar-radiometric method was proposed for determining water reserves and liquid-water content of cirrus clouds. The method involves measurement of the emissivity of cirrus clouds in the range 8-13 $\mu$m and use of a mean statistical model of their microphysical characteristics. Research was with an IR radiometer operating in the wavelength range 8-13 $\mu$m and a lidar operating at a wavelength 0.53 $\mu$m. [The measurement method and procedures for ascertaining emissivity of cirrus clouds were set forth by V.A. Zhuravleva in IZV. AN SSSR: Vol 19, No 11, pp 1167-1171, 1983.] It was found that the maximum liquid-water content is in the lower half of the clouds, a result consistent with data published earlier: the greatest concentration of crystals and large crystals is at the cloud base and therefore the lower part of clouds should contain greater liquid-water contents. The water reserves and liquid-water contents in the observed Ci clouds were 5-30 $g/m^2$ and 0.005-0.03 $g/m^3$ respectively with mean values 12 $g/m^2$ and 0.13 $g/m^3$. There is a dependence of the water reserves in Ci clouds on cloud temperature; with a temperature increase the cloud water reserves increase. The error in determining water reserves and liquid-water content by the proposed method is about 40%. The greatest errors are attributable to use of a priori data on cloud microstructure. Figures 4; references 17: 7 Russian, 10 Western.

UDC 551.521.32

## ABSORPTION OF FAR IR-RADIATION BY $H_2O$-$N_2$ COMPLEXES UNDER ATMOSPHERIC CONDITIONS

Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA in Russian Vol 22, No 1, Jan 86 (manuscript received 27 Jul 84) pp 30-35

[Article by A. A. Vigasin and G.V. Chlenova, Atmospheric Physics Institute, USSR Academy of Sciences]

[Abstract] A study was made of ways to interpret the mechanisms of extinction of far-IR radiation in the earth's atmosphere. It was noted that in limited

spectral intervals there is absorption, having a quasicontinuum nature, excess relative to $H_2O$ monomers. A distinctive feature of this absorption is its linear dependence on the partial pressure of water vapor. An effort was made to relate this absorption to $H_2O$-$N_2$ complexes. The study was limited to hydrogen-bound complexes. Only the spectral region $\nu < 1000$ cm$^{-1}$ was considered (five intermolecular oscillations of the complex fall in this region). An in-depth study was made of the behavior of the hydrogen-bound $H_2O$-$N_2$ complex. It was found that the region of intermolecular oscillations is limited to the frequency range $50 < \nu < 250$ cm$^{-1}$. Estimates of the concentration of complexes were made under atmospheric conditions. It was demonstrated that the $H_2O$-$N_2$ complexes present in the atmosphere can make a contribution (together with $(H_2O)_2$ dimers) to the extinction of IR radiation. The part of the excess absorption of water vapor in mixture with nitrogen, linear relative to water vapor pressure in the far-IR, can with confidence be attributed to $H_2O$-$N_2$ complexes. Figures 2; references 15: 9 Russian, 6 Western.

UDC 551.511.6

## STRUCTURE OF STABLY STRATIFIED ATMOSPHERIC SURFACE LAYER IN PRESENCE OF HEAT-RELEASING ADMIXTURE

Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA in Russian Vol 22, No 1, Jan 86 (manuscript received 7 May 84) pp 10-16

[Article by L. Kh. Ingel, Experimental Meteorology Institute]

[Abstract] A nonlinear semi-empirical model of a horizontally homogeneous stably stratified surface layer is presented in which the atmosphere contains a weightless heat-releasing admixture simulating an aerosol which absorbs solar radiation. (In such a formulation when the air is heated the admixture favors development of stable stratification at the surface and if the admixture concentration and the heat release associated with it increase with altitude in the surface layer a stable stratification would result in the entire layer.) The heat source was assumed to be proportional to the partial density of the admixture. First a "background" stationary solution is found for the pertinent system of equations in the absence of a heat-releasing admixture and then appropriate boundary conditions are selected for solving the final problem. In a stationary case it was possible to find a general analytical solution of a system of equations for the balance of turbulent energy in Kolmogorov form, transfer of heat, admixture and momentum. However, stationary solutions are possible only in some range of values of parameters of the problem. It was found that there is a critical value of the flux of admixture through the surface layer above which stationary solutions are impossible. As heat release continues stratification becomes increasingly stable, resulting in a suppression of turbulent exchange. The heat flux first increases a little in absolute value and only then decreases. A specific example of the computations is given. Figures 1; references 9: 8 Russian, 1 Western.

UDC 528.061.2:528.54:621.375.826

CONSIDERING REFRACTION IN LEVELING WITH LASER PLANE

Moscow GEODEZIYA I KARTOGRAFIYA in Russian No 2, Feb 86 pp 17-21

[Article by Yu.S. Galkin and G.G. Pobedinskiy]

[Abstract] The practical experience gained in studying the influence of refraction on the accuracy of measurement of the heights of pickets in a topographic survey is analyzed. Heights were determined by leveling of a reference laser plane using an automatic altimeter over distances of about 800 m, sometimes up to 1300 m. Studies in the Moscow area in 1984 using the proposed method over a base of 600 m indicated an error of 2 mm in an agricultural area on a cloudy day with intermittent showers. The method, based on analysis of refraction by the registry of laser beam fluctuations, is said to be the simplest to implement and equal in accuracy to traditional methods. Figures 2; references 12: 10 Russian, 2 Western.

PLANS FOR EVACUATING ARCTIC STATION "SP-26", OPENING "SP-28"

LENINGRADSKAYA PRAVDA, 3 Mar 86, No 63 (21605), p 1

[Article by S. Nikonov]

[Text] The road of aircraft engines is a sign of the coming of spring in the polar basin. The high-latitude aerial expedition "Sever-38" has begun its work here.

V. V. Kiselev, head of this expedition, radioed yesterday that research teams of scientists and specialists who are conducting observations of the condition of the ocean, the ice and the atmosphere have made their first landings on drifting ice fields. These studies are being done in line with the long-term large-scale program "POLEKS-Sever" ("North Polar Experiment").

The radiogram reported that air transport operations for the replacement of research teams and the supplying of drifting stations are continuing at the same time. Polar explorers will soon abandon the station "SP-26", which has completed its program. Its equipment will be turned over to a new research group--the Young Communist station "SP-28". [See the Daily SNAP, 28 Jan 86, p 2] A search has begun for a suitable ice floe for this station. It is supposed to open by May. The runway on the ice floe of the drifting station "SP-27", which suffered a series of breakups recently, has been rebuilt following emergency operations. The station has reported that it is ready to receive transport airplanes.

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CSO: 1865/236

MORE ON PLANS FOR ANTARCTIC RESEARCH VESSEL 'AKADEMIK FEDOROV'

Moscow VODNYY TRANSPORT, 19 Apr 86, No 47 (9010), p 4

[Article by A. Shishkov, sea captain, deputy of the Arctic and Antarctic Marine Administration of the USSR State Committee on Hydrometeorology and Monitoring of the Natural Environment and D. Maksutov, Candidate of Technical Sciences, shipbuilding engineer, senior science associate of the Arctic and Antarctic Scientific Research Institute]

[Abstract] A diesel-electric scientific expeditionary vessel for active navigation of icebound waters is being built to Soviet orders by the Finnish firm "Rauma-Repola", for Soviet Antarctic expeditions. [See the Daily SNAP, 24 Feb 1986, p 3] Plans call for putting this new vessel into service in the second half of 1987. The new electric motor ship has been named for academician Ye. K. Fedorov, an outstanding Soviet geophysicist, public figure and eminent polar researcher.

Specialists of the Arctic and Antarctic Institute and of the Arctic and Antarctic Marine Administration of the USSR State Committee on Hydrometeorology and Monitoring of the Natural Environment drafted specifications for the designing and construction of this vessel. The "Rauma-Repola" firm has begun preparing a technical design and conducting tests of a model of the vessel in an ice-testing tank.

The ice qualities and seaworthiness of the scientific expeditionary vessel "Akademik Fedorov" will be completely suitable for the difficult conditions in which it will have to operate in the waters of high, cold southern latitudes. Its hull is to be built according to the USSR Shipping Register's rules for vessels of the reinforced ice class, with the additional stipulation that the design of the vessel's side covering must withstand compression by ice fields up to 1.8 meters thick.

The vessel will have a deadweight of almost 7,600 tons, and its displacement when fully loaded will be about 16,200 tons. Its main propulsion plant will have a capacity of 16,500 kilowatts (effective horsepower--22,444). Its fuel distance will be 20,000 miles, and its sea endurance will be 80 days.

Together with its crew of 90, the vessel will carry 160 participants of Soviet Antarctic expeditions on each of its transoceanic voyages to Antarctica. The seamen will transport various items of equipment and gear, large

consignments of foodstuffs and liquid fuel, instruments in containers, building structurals, aircraft, and ground transport equipment. The vessel's cargo-handling gear is designed for transloading of heavy items weighing up to 50 tons.

The scientific personnel of the "Akademik Fedorov" will have first-class oceanographic, meteorological, aerological, synoptic, hydrochemical, ice-research, hydrobiological and other laboratories at their disposal, as well as automatic weather stations and systems for probing the upper layers of the atmosphere.

FTD/SNAP
/9716
CSO: 1865/256

SITE SELECTED FOR FUTURE ARCTIC STATION "SP-28"

IZVESTIYA, 27 Mar 86, No 86 (21528), p 6

[Article by A. Ryabushev, correspondent]

[Abstract] As has been reported, the flag of the Young Communist drifting station "Severnyy polyus-28" (SP-28) will be raised in the Arctic Ocean at the end of April. [See the Daily SNAP, 20 Mar 86, p 4] This station's personnel will include 29 young polar specialists.

For four days, we had been flying in the northeast over the East Siberian Sea, beyond the 79th parallel. Engineer-hydrologist Vasiliy Ivanovich Shilnikov, an honored polar explorer, was bending over instruments, reading a map of the icy waste, and determining the thickness and approximate dimensions of an ice floe.

"Our task is to find an ice floe at least 3 meters thick and 1.5 kilometers long, so that two runways can be built on it," said Shilnikov.

"Will we find where it's hiding, marshal? joked Aleksandr Maksimovich Sokolov, commander of the IL-14 airplane.

Shilnikov has been dubbed an 'ice reconnaissance marshal' in the Arctic because of his tremendous experience. He began as an eingineer-hydrologist at SP-4, and he helped the Second Soviet Antarctic Expedition compile a map of the Antarctic continent's icy coast... And now new ice reconnaissance was under way, under the direction of Vladimir Vasilyevich Kiselev, head of the "Sever-38" expedition.

Suddenly, when the plane was 470 kilometers north of Zhokhova Island, Shilnikov exclaimed joyfully: "I see a good ice floe!" Every one of its parameters suited the ice-reconnaissance ace.

In a few days, an AN-2 airplane will fly the first landing party to a touch-down point on the ice floe.

(A photograph [omitted] is given showing Shilnikov seated at a window of the reconnaissance airplane.)

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AN-74 AIRPLANE LANDED ON 600-METER RUNWAY ON ICE FLOE

Moscow KOMSOMOLSKAYA PRAVDA in Russian 15 Mar 86, No 64 (18567), p 4

[Article by V. Snegirev, from Severnyy polyus-27 station]

[Abstract] The article gives an account of a recent operation in which members of the cross-ice ski expedition of the newspaper KOMSOMOLSKAYA PRAVDA were transported by air from the Arctic drifting station Severnyy polyus-27 (SP-27) to the mainland. For this operation an AN-74 airplane made a landing on the station's drifting ice floe. This was the first such landing by a jet transport airplane in the history of Soviet aviation. The airplane's crew was commanded by test-pilot Sergey Aleksandrovich Gorbik. They were taking part in a program of tests of the AN-74 in the eastern sector of the Arctic. [See the Daily SNAP, 17 Mar 86, p 2]

It is explained that the decision to use the AN-74 was made after conditions at SP-27 prohibited the landing of IL-14 airplanes there. As a result of compression of the ice, the station's runway had split into two sections, 600 and 300 meters long, which were separated by open water. The operation was preceded by practice flights in which the crew of the AN-74 made a number of shortened takeoff and landing runs on an ice airfield at the mouth of the Kolyma River.

It is recalled that the AN-74 made its first flight to SP-27 on March 14, traveling a distance of 1,630 kilometers. The station was located near the pole of relative inaccessibility. The flight began after a radio message was received from SP-27 reporting that the 600-meter section of runway there had been cleared of snow. At the time, the temperature was minus 37 degrees and visibility was 10 kilometers at the station. The AN-74 left Chokurdakh at 1226 hours Moscow time, and landed at the station at 0340 hours. Its landing run took only 300 meters. The airplane's crew subsequently made a trial takeoff without passengers from the ice floe. Although the runway had become covered with snow, this takeoff was accomplished with a run of 400 meters.

FTD/SNAP
/9716
CSO: 1865/236

## HEAD OF ARCTIC SKI-HIKING GROUP COMMENTS ON EXPERIENCES

IZVESTIYA, 29 Mar 86, No 88 (21530), p 3

[Article by G. Alimov, (interviewer)]

[Abstract] The article is an interview with D. Shparo, leader of an expedition which recently crossed ice on skis between the Arctic drifting stations SP-26 and SP-27. [See the Daily SNAP, 20 Feb 86, p 3, and 17 Mar 86, p 1] The crossing took 38 days and covered 700 kilometers. Shparo, who is a docent at the Moscow Steel and Alloys Institute, has led several expeditions of Arctic explorer-enthusiasts over the past 15 years.

Shparo said the crossing which his group made could not have been accomplished as recently as 10 years ago--such has been the recent improvement of the gear, food rations and support equipment for this type of undertaking. He mentioned a space-communications radio buoy of the "Kospas" system which was indispensable to his group in keeping track of their location, particularly in reaching the pole of relative inaccessibility in the course of the crossing. He also praised batteries which withstood temperatures as low as minus 50 degrees. These batteries were developed at the Novocherkassy Polytechnic Institute. The group had special instruments that permitted contact with airplanes which dropped supplies for the group. Also mentioned is a raft weighing only 1.5 kilograms which the group members carried and used to cross water between ice floes. The raft can support 150 kilograms of load.

Shparo described the group's rations, which included a kind of porridge consisting of milk, meat, butter and groats, and also pot cheese, warm milk with butter, dry sausage, dry biscuits, fat, candies and dried apricots.

Shparo said that the Clinical and Experimental Medicine Institute in Novosibirsk was a co-sponsor of the expedition. It planned biochemical studies which were performed and will be useful in clarifying processes of adaptation to extreme conditions.

Commenting on psychological stresses posed by trying to keep orientation in gloomy darkness, Shparo said he experienced hallucinations and mirages which caused great nervous fatigue. The hallucinations took the form of seeing what appeared to be buildings on the icescape and other, abstract visions. He said that several days into the hike, all members of the group reported experiencing such visions.

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PLANS FOR AIRLIFT DROP OF PERSONNEL AND CARGO AT ARCTIC STATION

Moscow KRASNAYA ZVEZDA, 11 Apr 86, No 88 (18975), p 4

[Article by S. Nechayuk, correspondent]

[Abstract] The article reports on plans for an airlift operation called EKSPARK-86, which is an acronym for 'arctic parachute expedition for dropping personnel and cargo.' It is to involve an airlift and drop of nearly 40 parachutists plus equipment onto the drifting ice floe where the Arctic station SP-28 is to be organized. An IL-76md airplane was scheduled to fly from the mainland town of Tiksi for a distance of 1,350 kilometers to the point in the Arctic Ocean where the SP-28 site has been fixed. Its geographical coordinates are 78 degrees 42 minutes North, and 168 degrees 55 minutes East.

It is recalled that a similar operation was carried out in 1984. Called EKSPARK-84, it involved the dropping of 14 parachutists plus fuel and equipment, including a tractor, for the stations SP-26 and SP-27. The group helped the crews of these stations unload the equipment.

Aleksandr Sidorenko, leader of the new airdrop group, said that in addition to helping set up the new SP-28 station, the group would deliver fuel and equipment for the SP-27 station. At SP-28, their activity was to include making a runway for light aircraft.

The expedition's physician is Doctor of Medical Sciences Vladislav Luchshev, who is a professor of the Second Moscow Medical Institute imeni Pirogov. He pointed out that the group would have to work in difficult conditions involving cold, high humidity, and oxygen deficiency of a type that would be typical for elevations of 4,000-6,000 meters. There are two other medical personnel assigned to the group, and they plan to conduct medical research. The studies will include questions of the psychophysiological compatibility of people in extreme conditions.

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## DISSIPATION OF MECHANICAL ENERGY IN ICE

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 285, No 6, Dec 85 (manuscript received 22 Mar 85) pp 1362-1364

[Article by V.A. Fomin and V.N. Rodionov, Earth Physics Institute imeni O. Yu. Shmidt, USSR Academy of Sciences, Moscow]

[Abstract] A discussion is presented of experimental data indicating a specific dissipative mechanism of mechanical energy in ice. An explosive charge with a mass of 0.4 g was placed in blocks of ice measuring 175 x 195 x 110 cm, yielding an explosive energy of 536 kcal. The ice was maintained at -1°C during the experiments. The mass velocity was measured at various distances from the charge, as were stresses. The data indicate that when the ice is deformed beyond the elastic limit, a crush structure develops so that melting occurs at the boundaries of the fragments, which are intensively mixed with each other, rather than melting of larger volumes of ice. The condition of maximum energy dissipation is an oscillating frequency comparable to $d/m$ [a parameter defined in the text.] The dissipative processes accompanying dynamic deformation of ice are significantly influenced by films of water at the boundaries of foreign particles or blocks in the crushed structure. Figure 1; references 5: 3 Russian, 2 Western.

UDC 551.343.74.001:536.421.4

## WATER FREEZING AND ICE MELTING IN DISPERSE ROCKS

Moscow VESTNIK MOSKOVSKOGO UNIVERSITETA, SERIYA 4: GEOLOGIYA in Russian No 1, Jan-Feb 86 (manuscript received 17 Dec 84) pp 53-66

[Article by E. D. Yershov, Moscow State University]

[Abstract] The theory of crystallization of fluids is far from fully developed in its physicochemical and thermodynamic aspects. The phase transitions of free water into ice and vice versa are far from fully understood. The structure of water has been studied inadequately and much remains to be understood with respect to the structure and phase transitions

of bound water in disperse systems. An in-depth review of these subjects has been made [although no bibliography accompanies this review]. The transformation of water into ice and ice into water is examined in depth. The freezing process, the transition of the structure of water into the structure of ice, is analyzed. All aspects of the crystallization of water are considered, with emphasis on the phase transitions of bound water into ice. The behavior of supercooled water is closely studied. The behavior of ice and water at negative temperatures is discussed. Various hypotheses concerning these phenomena are reviewed. Since most of the review is concerned with pure water, these various phenomena are also examined for water and ice containing dissolved salts, cations and anions. The influence of a mineral surface on the structure of ice is given particular attention, since ice forming near a mineral surface has a specific structure different from the structure of ice forming at a considerable distance from such a surface. Figures 4.

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